The Vocalic Phonology of Mushunguli

A Senior Thesis

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by

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Abstract

Mushunguli, spoken along the lower Jubba river in Somalia, is an undescribed, endangered Bantu language related to Tanzanian Zigua. This study aims to describe and analyze the phonological processes affecting vowel sequences in Mushunguli, in an effort to contribute to understanding the grammar of the language. Mushunguli's status as an endangered and undescribed language makes documenting these processes critically important for the furthering of linguistic knowledge.

Working with a native speaker in regular elicitation sessions, data was gathered that established the grammatical patterns of the language. Multiple phonological processes were uncovered, and rules were formulated using the Incremental Constriction Model (Parkinson: 1996). These rules include fusion, glide formation, post-consonantal *y*-deletion, palatalization, *o*-conditioned glide deletion, homorganic glide deletion, and nasal syllabification. Analysis and data of both lexical and post-lexical rules is given, where applicable.

The most theoretically interesting rules discovered were fusion and palatalization. In fusion, the non-high vowel /a/ fuses with a following vowel, becoming a single, long, non-high vowel with the second vowel's place of articulation (front, back, or placeless). For example, the underlying form /ka-iva/ 'he heard' is realized in speech as [keeva]. This rule necessitated the use of Parkinson's Incremental Constriction Model to represent height, and requires that the vowel *a* be unspecified for place of articulation, breaking with the traditional rule formalization.

In palatalization, glide formation first changes the grammatical prefix /di/ to *dy*, and this output is further changed to the palatal stop [j]. This process is unusual in that it is sensitive to the syntactic context of the utterance—the rule only applies when the first phrasal node dominating the prefix is NP. For example, in /yonda di-edi/ → [yonda jeedi] 'good baboon,' the prefix on the adjective contracts, but in /yonda di-ambiza/ → [yonda daambiiza] 'a baboon helped,' the same prefix on the verb does not. Syntactically-conditioned phonological rules exist, but are usually related to prosody, not segmental phonology.

Acknowledgements

I want to thank Dr. David Odden for acting as my research advisor for this thesis. I greatly appreciate all of the guidance, wisdom, and patience he displayed over the course of this project. Secondly, I must thank Mohamed Ramedhan for his collaboration on this project as a language consultant. All the data provided in this thesis came from elicitations with Mr. Ramedhan, so without him, this thesis literally would not have been possible. Dr. Robert Levine provided insight and guidance during the Linguistics 699 Research Seminar I attended, and additionally provided feedback for the poster I created for the Denman Undergraduate Research forum. I am also grateful to Drs. Peter Culicover and Julie McGory, for providing support and additional insight into my topic.

Additionally, I'd like to thank the other members of the Mushunguli research group: Jefferson Barlew, Tyler Williams, Brandon Yackey, and Betsy Pillion. Each of these individuals assisted me either with additional data, explanations of aspects of the language that were outside the scope of my project, and comisseration during difficult times that arose over the course of this project.

Finally, I would like to thank my friends and family, most of whom are non-linguists. Thank you for your support and your caring. In particular, I want to thank my fiancé Evan Detwiler and my mother Susan Hout for their willingness to sit for hours and listen while I attempted to explain phonological theory to them. I know that you still do not understand Feature Geometry, but rest assured that the hours you spent listening to me try to explain it helped *me* to do so.

Despite the efforts of the above-mentioned individuals and others to lead me back on the right path when I went astray, it is possible that some errors will persist in this document after I have turned it in. These errors are mine and mine alone.

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Chapter 1: Introduction

1.1 Language Background

Mushunguli is a Bantu language spoken in southern Somalia, primarily along the lower Jubba river. A dialect of Chizigua, the language originates from further south in what is now Tanzania. The ancestors of modern Mushunguli speakers were taken as slaves to Somalia, but eventually escaped and formed their own community.

In 2006, Ethnologue estimated the number of Mushunguli speakers in Somalia to be 23,000, making them a language minority compared to other language groups from the same region such as Maay (1.86 million speakers) or Somali (8.34 million speakers). In Franklin County, home to the second-largest Somali community in the United States, Mushunguli speakers are a minority within a minority. Of the approximately 15,000 Somali immigrants living in the Franklin county area (CRP 2009), only about 100 are Mushunguli. Mushunguli's minority status makes it unsurprising that the language is completely undescribed in academic literature. As such, the purpose of this thesis is to help expand linguistic knowledge of the language by providing data and analysis of the language's vocalic phonology.

Mushunguli has a five-vowel system, written <a,i,u,e,o>. These vowels are arranged according to height and place in the table in 1.1.1.

(1.1.1) *Mushunguli Vowels*

V-PLACE / Height	Front ([cor])	Placeless	Back ([dor])
High ([closed])	i		u
Non-high	e	a	o

For the purpose of this thesis, I attempted to elicit as many examples of /V-V/ contexts both within and between words as possible. Mushunguli's five-vowel system gives twenty-five base underlying V-V contexts, not including potential interactions due to consonants. A table of these contexts, the expected result of their combination, and the actual results in both word-internal and phrasal contexts is given in 1.1.2. The basis for the expected forms primarily comes from attested phonological alternations in other Bantu languages. The expected forms are based on only the two vowels interacting in a word-formation level context—complications caused by multi-vowel sequences, consonants, etc. are not included. If the context was not elicited, either due to time constraints or impossibility, the entry is marked with a '?.'

(1.1.2) *Expectations and Surface Realizations for /V-V/*

Underlying	*Expected*	*Surface*	
		Word-Internal	*Phrasal*
/a-a/	a	[aa]	[aa]
/a-i/	e	[ee]	[ee]
/a-u/	o	[oo]	[oo]
/a-e/	e	[ee]	?
/a-o/	o	[oo]	?
/i-a/	ya	[yaa]	[ia]
/i-i/	yi	[ii]	[ii]
/i-u/	yu	[yuu]	[iu]
/i-e/	ye	[yee]	?
/i-o/	yo	[yoo]	?
/u-a/	wa	[waa]	[ua]
/u-i/	wi	[wii]	[ui]
/u-u/	wu	[uu]	[uu]
/u-e/	we	[wee]	?
/u-o/	wo	[woo]	?
/e-a/	ea	[ea]	[ea]
/e-i/	ei	[ei]	[ei]
/e-u/	eu	[eu]	[eu]
/e-e/	ee	[ee]	?

/e-o/	eo	[eo]	?
/o-a/	oa	?	[oa]
/o-i/	oi	?	[oi]
/o-u/	ou	?	[ou]
/o-e/	oe	?	?
/o-o/	oo	?	?

1.2 Presentation and Transcription

This thesis is divided into five chapters, including this introduction. To simplify glossing and provide justification for the underlying forms used in this thesis, Chapter Two consists of an introduction to the many prefixes and suffixes used in this thesis, along with some of the more common repeated words such as possessive pronouns. Mushunguli is an agglutinative language, and because most prefixes and suffixes in Mushunguli are vowel-final or bare vowels, many phonological changes can occur in a single utterance. This can obscure their underlying form. Chapter Two is not a glossary of every Mushunguli word used in this thesis, nor should it be considered a comprehensive listing of every prefix and suffix in the language. Chapter Three focuses on segmental phonology at the word-formation level, with relevant data and analysis for each rule. Chapter Four presents the relevant data and analysis of post-lexical phonological rules. Chapter Five summarizes and concludes the thesis.

There is no standard orthography for Mushunguli, so the Mushunguli research group developed one.[1] This is the transcription system used in this thesis, as I wanted to use the simplest system possible that would retain the relevant phonological facts of the language. For example, it is not relevant to the phonological analysis of the language that the vowel transcribed as <e> can be pronounced both [e] and [ɛ]. The two sounds are allophones of the same phoneme, so the vowel is written <e> regardless of how it is phonetically realized. The Mushunguli orthography is similar to IPA, with a few exceptions, given in the table in (1.2.1).

(1.2.1)

Mushunguli	IPA
sh	ʃ
ch	tʃ
dh	z ~ ð

[1] The Mushunguli research group is comprised of former members of Dr. David Odden's Spring 2011 Introduction to Field Methods class, along with Dr. Odden himself and Mohamed Ramedhan. In addition to describing various aspects of the language, the group also helped to develop an orthography for the language and translate folk stories to be given back to the Mushunguli community.

y	j
j	ʄ
ng’	ŋ (before V or non-velar C)
ny	ɲ
Ch	C^{h2}

The only complicated part of the Mushunguli spelling system is the representation of nasals. In the word-initial position, it is necessary to distinguish syllabic nasals from non-syllabic nasals. This is because the morpheme /mu-/ surfaces as [m̩] before consonants[3], but the morpheme /ny-/ surfaces as a non-syllabic nasal assimilated to the following consonant’s place of articulation and voicing. Examples of this, written in standard IPA for clarity’s sake, are given in 1.2.2.

(1.2.2)

Underlying	*Surface*	
/mu-gosi/	m̩goosi	‘man’
/mu-vere/	m̩veere	‘woman’
/mu-kulu/	m̩kuulu	‘big (class 1)’
/ɲ-oka/[4]	ɲooka	‘snake’
/ɲ-guluwe/	ŋguluuwe	‘pig’
/ɲ-paŋga/	ɱ̊p^{h}aaŋga	‘machete’
/ɲ-kuŋunto/	ŋ̊k^{h}uŋuunt^{h}o	‘dust storm’

As previously stated, non-syllabic nasals assimilate to the following consonant’s place of articulation. This is easy to represent with the labial and alveolar nasals [m,n]--they are just written <m,n>. Palatal nasals are written <ny>. However, velar nasals are slightly more complicated. Before non-velar consonants and vowels they are written [ng’]. However, before velar consonants they are just written [n], so the example [ŋguluwe] would be written [nguluwe] in Mushunguli. This contrast is made to distinguish <ŋgV> clusters (written <ngV>) from <ŋV> clusters (written <ng’V>).

The final complication comes from word-initial non-syllabic nasals. When a word-initial, non-syllabic nasal precedes another consonant, it assimilates to the second consonant’s voicing in addition to its place of articulation. Thus, any word-initial non-syllabic nasal preceding a voiceless consonant will be voiceless as well, as seen in the example [ɱ̊p^{h}aaŋga] ‘machete.’ Because voicing is predictable, no distinction is made in the transcription to account for it.

[2] Only when the C is voiceless and the segment preceding the C is a non-syllabic nasal.
[3] See section 3.7 on nasal syllabification.
[4] This is one possible analysis—it is possible that the underlying form is /ɲoka/, and the class prefix is deleted as a result.

The end result of all these seemingly complicated rules is a system that avoids diacritics and unusual, not terribly distinct characters. This is easier for a native speaker to learn. Table 1.2.3 translates the examples given in 1.2.2 from IPA to Mushunguli orthography.

(1.2.3)	*/IPA/*	*[IPA]*	/Mushunguli/	*[Mushunguli]*
	/mu-gosi/	[m̥goosi]	/mu-gosi/	[m̥goosi]
	/mu-vere/	[m̥veere]	/mu-vere/	[m̥veere]
	/mu-kulu/	[m̥kuulu]	/mu-kulu/	[m̥kuulu]
	/ɲ-oka/	[ɲooka]	/ny-oka/	[nyooka]
	/ɲ-guluwe/	[ŋguluuwe]	/ny-guluwe/	[nguluuwe]
	/ɲ-paŋga/	[m̥p^{h}aaŋga]	/ny-panga/	[mphaanga]
	/ɲ-kuŋunto/	[ŋ̊k^{h}uŋuunt^{h}o]	/ny-kung'unto/	[nkhung'uuntho]

There are no underlying long vowels in Mushunguli. However, there are surface long vowels[5]. These are transcribed as a double vowel; for example, /si-ja/ → [siija] 'I ate.' Again, this is to avoid diacritics and arcane symbols. This will most commonly arise due to a rule that lengthens the penultimate vowel of an utterance, and as such penultimate syllables are transcribed as lengthened.

There is also a surface distinction between long vowels and disyllabic vowels which resemble long vowels. Because of this, disyllabic vowels are transcribed with a syllable break, i.e. [aa] vs. [a.a].

Finally, it is worth mentioning that Mushunguli is a tonal language. Tonal data is not included in these transcriptions, as it generally had no influence on the analysis of the language's segmental phonology.

1.3 Rule formulation

The phonological rules presented in this thesis are written using Unified Features Theory (Clements & Hume: 1995), with one exception. I use a modified version of height introduced in Parkinson (1996). In Clements and Hume, vowel height is indicated by tiered instances of [open] under the aperture node (1995). These tiers are numbered (a higher number indicating a lower tier), and are binary rather than privative. For example, in a three-height system, a low vowel would be [+open$_1$, +open$_2$], a mid vowel would be [-open$_1$, +open$_2$], and a high vowel would be

[5] The ways these can arise are discussed in Chapter 3.

[-open$_1$, -open$_2$]. The higher-numbered tiers are referred to as "lower" because they appear lower than the lower-numbered tiers in the visual representation of the rule.

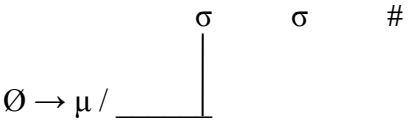
Parkinson's model replaces the aperture node with a Height node and uses multiple instances of [closed]—the more instances, the higher the vowel is (1996). [closed] is the opposite of [open], representing a degree of constriction rather than a degree of opening. Additionally, instead of iterative instances of [open] lined up next to each other, [closed] is stacked recursively. Taken at its core, the aperture model is simply a non-linear representation of now-disused distinctive features such as [mid], [high] etc., while Parkinson's model actually treats height as a single feature.

Rules are presented with minimal structure that can be predicted by rule. For example, a high vowel can be represented as an association between a mora and [closed]. This is because every node dominating [closed] up to the mora is unique and non-contrastive (being dominated by a mora or not *is* contrastive). However, the structure that an association line docks to or detaches from will always be included, even if that structure is otherwise predictable. In derivations, additional structure may be referred to for illustrative purposes, or, in the case of derivations demonstrating interacting processes, because the structure is relevant for one of the rules.

1.4 Vowel Length

This thesis primarily focuses on the segmental phonology of Mushunguli, but some observations about vowel length can be made. Mushunguli has no underlying long vowels, but does have surface derived long vowels. Most commonly, these occur in the penultimate or antepenultimate syllables of an utterance. Penultimate lengthening is usually caused by stress assignment. For example, /si-ja/ → [siija] 'I ate.' This means an additional mora is added to the penultimate syllable, as illustrated in 1.4.1.

(1.4.1) *Penultimate Lengthening*



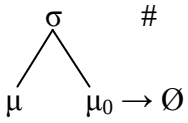
Antepenultimate lengthening most commonly surfaces due to Compensatory Lengthening, which is a repair process caused by phonological rules. When the mora of an initial segment is detached via some phonological rule, it automatically docks to the syllable and root nodes of the moraic segment immediately following it. This produces a long vowel—for example, /ka-ikala/ → [keekaala] 'he/she sat.' Monosyllabic long vowels derived by stress assignment and Compensatory Lengthening are phonetically the same. Because of this, it is

impossible to determine which process causes the lengthening of a penultimate syllable that could be affected by both. For example, /wa-iva/ → [weeva] ‘they heard’ could be lengthened by either (or both) processes.

There are also disyllabic long vowels, written [V.V], which are phonetically distinct from long vowels derived via penultimate lengthening. These arise when two identical vowels occur in sequence, but are not affected by phonological rules. In particular, this seems to affect /awa/ → [a.a].

Additionally, there are some obvious restrictions on vowel length. The final syllable of an utterance can never be long, and will be shortened if Compensatory Lengthening affects a /V-V/ context there. This is most apparent in derivations of /-o/ ‘that (near speaker)’ due to its unusual formation[6]. For example, the last two vowels in the phrase /katumbiri a-ka-o/ ‘that vervet’ undergo Fusion and subsequent Compensatory Lengthening. However, this utterance will surface only as [katumbiri aako], never *[katumbiri aakoo]. I propose a rule of final shortening, given in 1.4.2, which deletes extra moras from a final syllable in Mushunguli.

(1.4.2) *Final Shortening*



Although derived monosyllabic long vowels clearly surface in the antepenultimate syllable, ones occurring outside of the antepenultimate syllable can be shortened. For example, /ka-umbik-isa/ ‘he/she piled things up a lot’ most commonly surfaces as [kombikiisa][7], with no apparent lengthening of the first vowel. Long vowels in phrases can also be shortened. For example, while [mwaana] ‘child’ has a lengthened penultimate syllable when the word is said alone, it does not necessarily surface with one in phrases examples such as [mwana ywaangu] ‘my child.’ There is a possibility of free variation, as forms such as [mwaana ywaangu] have surfaced as well. Additional research needs to be conducted to determine the rules of shortening in long forms and phrases.

[6] Most demonstratives are formed by the concatentation of the demonstrative series prefix with the demonstrative stem. In the case of /-o/, the augment prefix is used as well (i.e. Aug-Dem-o).
[7] See section 3.1 for an explanation of Vowel Fusion.

Chapter 2: Morphology

There are many verbal and nominal affixes in Mushunguli. These convey semantic content such as person and number, tense, noun class, reflexivity, subject, object, augmentative properties, and so on. Because nearly every prefix is either vowel-final or a single vowel, their surface forms are frequently modified by phonological rules. This chapter is devoted to giving an as exhaustive as possible listing of the underlying forms of the affixes in Mushunguli used in this thesis, with data motivating the analysis. There are likely additional affixes that were not discovered in the course of this project, but it is assumed that the phonological rules described in this thesis will apply to them normally.

2.1 Noun Class Prefixes

Mushunguli has 13 noun classes, conventionally numbered 1-10, 12, 14, and 15. A noun's class is indicated by appending the appropriate nominal prefix to its stem. Classes 1-10 are (generally) singular-plural pairs, i.e. class 1 singular nouns have class 2 plural forms, class 3 corresponds with class 4, and so on. Class 12 refers to diminutives, and the class 12 prefix can technically be appended to any noun stem to form a diminutive of that noun. It is still considered a separate class because some lexical items are specific to it (e.g. *kadhana* 'baby'), and because any noun with the class 12 prefix takes class 12 agreement patterns.[8] Class 15 refers to infinitival nominalized verbs, and has restricted usage. Class 14 is something of a hodgepodge of lexical items that likely once belonged to other classes in the language (such as class 11) that for historical reasons have been lost. A table giving the nominal class prefixes, along with data motivating their forms, is given in 2.1.1.

(2.1.1)

Class	Prefix	Examples	
1	*mu*	ṃgoosi	'man'
		ṃveere	'woman'
		mwaana	'child'
2	*wa-*	wagoosi	'men'
		waveere	'women'
		waana	'children'
3	*mu-*[9]	ṃnyaawu	'cat'
		ṃti	'tree'
		mweezi	'month'
4	*mi-*	minyaawu	'cats'

[8] For example, [kagosi keedi] 'good small man' (c.f. [ṃgosi yweedi] 'good man').

[9] Although the nominal class prefixes are the same for classes 1 and 3, other agreement prefixes such as the demonstrative series prefix are different. Additionally, the two classes have separate plural "counterpart" classes—class 1 nouns generally have class 2 plural forms, and class 3 nouns generally have class 4 plural forms.

		miiti	‘trees’
		meezi	‘months’
5	Ø	yoonda	‘baboon’
		kuuwi	‘turtle’
		booko	‘banana’
6	*ma-*	mayoonda	‘baboons’
		makuuwi	‘turtles’
		mabooko	‘bananas’
7	*chi-*	chiboonkho	‘hippopotamus’
		chireevu	‘chin’
		chisaanga	‘dry river’
8	*vi-*	viboonkho	‘hippopotamuses’
		vireevu	‘chins’
		visaanga	‘dry rivers’
9	*ny-*[10]	nguluuwe	‘pig’
		suuwa	‘dove’
		mbwa	‘dog’
10	*ny-*	nguluuwe	‘pigs’
		suuwa	‘doves’
		ṃbwa	‘dogs’
12	*ka-*	kabuuga	‘bunny’
		kadhaana	‘baby’
		kaloogo	‘duiker’
14	*u-*	uloosi	‘language’
		uliimi	‘tongue’
		utuumbo	‘intestine’
15	*ku-*	kumuliika	‘lightning; flashing’
		kuuja	‘eating’
		kuugwa	‘falling’

The nominal series prefixes are used to form agreement within the noun phrase with most adjectives and the numbers 2-5. The set of nominal series prefixes is given in (2.1.2), using the example adjective /kulu/ ‘big.’

(2.1.2)

Class	Prefix	Example	
1	*mu-*	ṃgosi ṃkuulu	‘big man’
2	*wa-*	wagosi wakuulu	‘big men’
3	*mu-*	ṃti ṃkuulu	‘big tree’
4	*mi-*	miti mikuulu	‘big trees’
5	*null/di*[11]	yonda kuulu	‘big baboon’
6	*ma-*	mayonda makuulu	‘big baboons’
7	*chi-*	chiga chikuulu	‘big leg’

[10] If this prefix precedes a fricative, it is deleted.
[11] See 3.

8	*vi-*	viga vikuulu	‘big leg s’
9	*ny-*	simba nkhuulu	‘big lion’
10	*ny-*	simba nkhuulu	‘big lions’
12	*ka-*	kabuga kakuulu	‘big bunny’
14	*mu-*	uta ṃkuulu	‘big bow’
15	*ku-*	kumulika kukuulu	‘big lightning’

The demonstrative series prefix is primarily used to form agreement in demonstrative words, but can also apply to several other kinds of words; for example, possessive pronouns such as /-angu/ ‘my’ and the word /-edi/ ‘good,’ which is semantically an adjective but behaves like a demonstrative. A full summary of all potential demonstratives will not be given in this thesis. Instead, the (possibly only) consonant-initial demonstrative /no/ ‘this (close to speaker)’ is used to illustrate the underlying forms of these prefixes in (2.1.3).

(2.1.3)

Class	Prefix	Example	
1	*yu-*	ṃvere yuuno	‘this woman’
2	*wa-*	wavere waano	‘these women’
3	*u-*	ṃto uuno	‘this river’
4	*i-*	mito miino	‘these rivers’
5	*di-*	buku diino	‘this book’
6	*ya-*	mabuku yaano	‘these books’
7	*chi-*	chisuse chiino	‘this scorpion’
8	*vi-*	visuse viino	‘these scorpions’
9	*i-*	shaba iino	‘this pan’
10	*zi-*	shaba ziino	‘these pans’
12	*ka-*	kabuga kaano	‘this bunny’
14	*u-*	ulosi uuno	‘this language’
15	*ku-*	kumulika kuuno	‘this lightning’

The augmentative prefix, also known as the pre-prefix or just the augment, indicates definiteness.[12] A paradigm of definite and indefinite forms of nouns is given in (2.1.4) to illustrate the forms of these prefixes.

(2.1.4)

Class	Prefix	Example	
1	*u-*	uumnthu	‘the person’
		ṃnthu	‘person’
2	*a-*	awaanthu	‘the people’
		waanthu	‘people’
3	*u-*	uumtwi	‘the head’
		ṃtwi	‘head’
4	*i-*	imiitwi	‘the heads’

[12] The augment may have additional functions, but its exact semantic properties were outside the scope of this project.

		miitwi	‘heads’
5	*i-di-*[13]	idijuula	‘the frog’
		juula	‘frog’
6	*a-*	amajuula	‘the frogs’
		majuula	‘frogs’
7	*i-*	ichiboonkho	‘the hippopotamus’
		chiboonkho	‘hippopotamus’
8	*i-*	iviboonkho	‘the hippopotamuses’
		viboonkho	‘hippopotamuses’
9	*i-*	imboogo	‘the buffalo’
		mboogo	‘buffalo’
10	*i-*	imboogo	‘the buffalos’
		mboogo	‘buffalos’
12	*a-*	akahuuji	‘the hawk’
		kahuuji	‘hawk’
14	*u-*	uutuumbo	‘the intestine’
		utuumbo	‘intestines’
15	*u-*	ukumulika	‘the lightning’
		kumuliika	‘lightning’

A definite NP also triggers the addition of the augment on any adjectives—data summarizing this behavior is given in (2.1.5), using /dodo/ ‘small.’ Because of post-lexical fusion, examples such as /i-mipira i-midodo/ will surface as [imipire emidoodo] rather than *[imipira imidoodo]. See section 4.1 for an explanation of this phenomenon.

(2.1.5)

Class	Example	
1	umgosi umdoodo	‘the small man’
	ṃgosi ṃdoodo	‘small man’
2	awagosi awadoodo	‘the small men’
	wagosi wadoodo	‘small men’
3	umpiro omdoodo	‘the small ball’
	ṃti ṃdoodo	‘small ball’
4	imipire emidoodo	‘the small balls’
	mipira midoodo	‘small balls’
5	idigutwi ididoodo	‘the small ear’
	gutwi doodo	‘small ear’
6	amagutwi amadoodo	‘the small ears’
	magutwi madoodo	‘small ears’
7	ichifuwe echidoodo	‘the small chest’
	chifuwa chidoodo	‘small chest’
8	ivifuwe evidoodo	‘the small chests’
	vifuwa vidoodo	‘small chests’
9	inthangulu indoodo	‘the small basket’

[13] The augmented form of class 5 nouns always take the demonstrative series prefix in addition to the augment.

	nthangulu ndoodo	‘small basket’
10	inthangulu izidoodo[14]	‘the small baskets’
	nthangulu ndoodo	‘small baskets’
12	akabuga akadoodo	‘the small bunny’
	kabuga kadoodo	‘small bunny’
14	uubongo umdoodo	‘the small brain’
	ubongo ṃdoodo	‘small brain’
15	ukumuliko okudoodo	‘the small lightning’
	kumulika kudoodo	‘small lightning’

2.2 Verbal Agreement

All Mushunguli verbs (except for imperatives) will have a subject prefix concatenated with the verb. This prefix will contain information regarding either noun class or person and number. The set of subject prefixes by noun class are given in (2.2.1), using the past tense forms[15] of the sample verbs /ja/ ‘eat’ and /gwa/ ‘fall.’

(2.2.1)

Class	Prefix	Example	
1	*ka-*	umgosi kaaja	‘The man ate’
2	*wa-*	awagosi waaja	‘The men ate’
3	*u-*	umti uugwa	‘The tree fell’
4	*i-*	imiti iigwa	‘The trees fell’
5	*di-*	idiyonda diija	‘The baboon ate’
6	*ya-*	amayonda yaaja	‘The baboons ate’
7	*chi-*	ichisuse chiigwa	‘The scorpion fell’
8	*vi-*	ivisuse viigwa	‘The scorpions fell’
9	*i-*	isimbe eja[16]	‘The lion ate’
10	*zi-*	isimba ziija	‘The lions ate’
12	*ka-*	akabuga kaagwa	‘The bunny fell’
14	*u-*	uuto ogwa	‘The bow fell’
15	*ku-*	ukumulika kuugwa	‘The lightning fell’

It is worth noting that the subject in these sentences does not have to be explicitly stated—i.e. one could say [isimba ziija] ‘the lions ate’ or simply [ziija] ‘they (cl. 10) ate.’

In the case of all noun classes besides 1, the form of the subject prefix does not change based on tense. However, Class 1 and 2, which refer to human beings, have an expanded set of pronominal class prefixes representing 1-3rd singular human subjects. These prefixes are

[14] Adjectives modifying definite class 10 nouns take the prefix /zi-/ in addition to the prefix /ny-/.
[15] Past tense is used because it lacks a tense prefix.
[16] Examples which predicted *a-i* and *a-u* instead surface as [e e] and [o o] are affected by lexical Fusion, discussed in section 3.1.

represented in (2.2.2), using the verb *chema* ‘sing’ in the past, present, and subjunctive tenses. Plural subjects are invariant, but are included for comparison’s sake.

(2.2.2) *Pronominal Subject Prefixes*

Past				
1st	Sg	*si-*	sicheema	‘I sang’
	Pl	*chi-*	chicheema	‘we sang’
2nd	Sg	*ku-*	kucheema	‘you sang’
	Pl	*mu-*	ṃcheema	‘you pl. sang’
3rd	Sg	*ka-*	kacheema	‘he/she sang’
	Pl	*wa-*	wacheema	‘they sang’
Present				
1st	Sg	*ni-*	naacheema	‘I am singing’
	Pl	*chi-*	chaacheema	‘we are singing’
2nd	Sg	*u-*	waacheema	‘you are singing’
	Pl	*mu-*	mwaacheema	‘you pl. are singing’
3rd	Sg	*a-*	aacheema	‘he/she is singing’
	Pl	*wa-*	waacheema	‘they are singing’
Subjunctive				
1st	Sg	*ni-*	nanicheeme	‘I will sing’
	Pl	*chi-*	nachicheeme	‘we will sing’
2nd	Sg	*u-*	noocheeme	‘you will sing’
	Pl	*mu-*	namcheeme	‘you pl. will sing’
3rd	Sg	*a-*	naacheeme	‘he will sing’
	Pl	*wa-*	nawacheeme	‘they will sing’

2.3 Object Prefixes and Pronouns

Objects are indicated several ways in Mushunguli, and the use of object prefixes is very flexible, depending on how specific the speaker wants to be. The most specific way is to state the direct object after the verb with no object prefix, such as in the sentence *ṃgosi katoa simba* ‘a man hit a lion.”

If an object prefix is used, it is attached to the verb after the subject and before tense-aspect morphemes. Puzzling out the underlying forms of these prefixes can be difficult because many of them are bare vowels, and the only way to reach the correct underlying form is to understand the phonological rules that affect the utterance. In order to provide sufficient evidence, two sample utterances, one with a consonant-initial root and one with a vowel-initial root, are given in the examples. Additionally, different subject prefixes may be used in order to

avoid doubled vowels where possible. Please see Chapter 3 for explanations of the relevant phonological rules.

In 2.3.1, examples of the object prefixes referring to the noun classes are given.

(2.3.1) *Noun Class Object Prefixes*

Class	Prefix	Underlying	Surface	
1	*mu-*	/ku-mu-toa/	kumtooa	'You hit him/her'
		/ku-mu-iva/	kumwiiva	'You heard him/her'
2	*wa-*	/ku-wa-toa/	kuwatooa	'You hit them'
		/ku-wa-iva/	kuweeva	'You heard them'
3	*u-*	/si-u-toa/	suutooa[17]	'I hit it (cl. 3)'
		/si-u-iva/	siwiiva	'I heard it (cl. 3)'
4	*i-*	/ku-i-toa/	kwiitooa	'You hit them (cl. 4)'
		/ku-i-adha/	kuyaadha	'You lost them (cl.4)'
5	*di-*	/si-di-toa/	siditooa	'I hit it (cl. 5)'
		/si-di-adha/	sidaadha	'I lost it (cl. 5)'
6	*ya-*	/si-ya-toa/	siyatooa	'I hit them (cl. 6)'
		/si-ya-iva/	siyeeva	'I heard them (cl. 6)'
7	*chi-*	/si-chi-toa/	sichitooa	'I hit it (cl. 7)'
		/si-chi-adha/	sichaadha	'I lost it (cl. 7)'
8	*vi-*	/si-vi-toa/	sivitooa	'I hit them (cl. 8)'
		/si-vi-adha/	sivaadha	'I lost them (cl. 8)'
9	*i-*	/ku-i-toa/	kwiitooa	'You hit it (cl. 9)'
		/ku-i-adha/	kuyaadha	'You lost it (cl. 9)'
10	*zi-*	/si-zi-toa/	sizitooa	'I hit them (cl. 10)'
		/si-zi-adha/	sizaadha	'I lost them (cl. 10)'
12	*ka-*	/si-ka-toa/	sikatooa	'I hit it (cl. 12)'
		/si-ka-iva/	sikeeva	'I heard it (cl. 12)'
14	*u-*	/si-u-toa/	suutooa	'I hit it (cl. 3)'
		/si-u-iva/	siwiiva	'I heard it (cl. 3)'

Additionally, there are a set of pronominal object prefixes referring to humans. These are similar to the pronominal subject prefixes discussed earlier, except that their form does not change with tense. 1st and 2nd singular and plural are given in 2.3.2, as the 3rd person prefixes are just the Class 1 and 2 prefixes.

(2.3.2) *Pronominal Object Prefixes*

Person	Number	Prefix	Underlying	Surface	
1st	Sg	*ni-*	ka-ni-toa	kanitooa	'he/she beat me'
	Pl	*chi-*	wa-chi-toa	wachitooa	'they beat us'

[17] See section 3.4 for an explanation of post-consonantal *y*-deletion.

2nd	Sg	*ku-*	si-ku-toa	sikutooa	'I beat you'
	Pl	*mu-* (*-ni*)	si-mu-toa-ni	simtoaani	'I beat you pl.'

Note that the suffix *–ni* is added to distinguish the 2nd plural object prefix from the 3rd singular, as these two object prefixes have the same shape.

Finally, it is worth noting that objects can appear in a phrase in two other ways. The first is by using the object prefix and the augmented object, as in /si-m-toa u-mgosi/ → [simtoa umgoosi] 'I hit (him) the man.' The second is by using the object prefix and a pronoun, as in /si-m-toa yeye/ → [simtoa yeeye] 'I hit him.' A topic for future research would be the semantic differences, if any, between the syntactic variants of the object in Mushunguli.

2.4 Common Words and Assorted Prefixes

Demonstrative determiners are the most common contexts for phonological alternations in Mushunguli outside of the verb phrase, as most of the stems that the agreement prefixes attach to are vowel-initial and combine with a vowel-final agreement marker. A table of common determiners is given in 2.4.1, using the example Class 3 noun /m-ti/ 'tree.'

(2.4.1)

Determiner	Example (UL)	Surface	
/-no/	/m-ti u-no/	[mti uuno]	'this'
/-o/[18]	/m-ti u-u-o/	[mti uuwo]	'that (near speaker)'
/-ja/	/m-ti u-ja/	[mti uuja]	'that (near listener)'
/-angu/	/m-ti u-angu/	[mti waangu]	'my'
/-ako/	/m-ti u-ako/	[mti waako]	'your (sg)'
/-ake/	/m-ti u-ake/	[mti waake]	'his/her/its'
/-etu/	/m-ti u-etu/	[mti weetu]	'our'
/-enyu/	/m-ti u-enyu/	[mti weenyu]	'your (pl)'
/-awo/	/m-ti u-awo/	[mti waawo]	'their'
/-ose/	/m-ti u-ose/	[mti woose]	'all'[19]

Finally, one prefix that has not yet been discussed is the reflexive prefix, /e-/. This prefix is always attached directly before the verb, and can be applied to any verb that can take a reflexive antecedent. A few examples are given with the verb /yaga/ 'scratch' in 2.4.1.

(2.4.1)

Underlying	*Surface*	
/si-e-yaga/	[seeyaaga]	'I scratched myself'
/u-a-e-yaga/	[weeyaaga]	'You are scratching yourself'

[18] As previously discussed, /-o/ concatenates the augment prefix and the demonstrative series prefix with the stem, rather than just the demonstrative series prefix.

[19] In the case of singular antecedents, this word is more accurately translated as 'the whole.'

/na-wa-e-yaga/ [naweeyaaga] ‘They will scratch themselves’

By referring back to this chapter, one should be able to keep track of the evidence motivating the underlying forms that will be used in Chapter 3.

Chapter 3: Lexical Vocalic Phonology

This chapter focuses on the vocalic phonology of Mushunguli at the level of word-formation. Phonological rules affecting vowels primarily revolve around the resolution of vowel hiatus and the aftermath thereof. This thesis does not include formal analysis of nasal assimilation or aspiration, which was mentioned briefly in Chapter 1.

3.1 Fusion

To begin, examine what happens when the non-high vowel *a* is followed by any other vowel. Table 3.1.1 contains several vowel-initial verbs. It includes their underlying form and the imperative, which is bare. While the imperative form is not a perfect way to determine the underlying forms for all verbs (see section 3.3), it is sufficient for the verbs in 3.1.1.

(3.1.1) *Verbal Data*

Underlying	*Imperative*	
/asama/	asaama	‘gape’
/ambidha/	ambiidha	‘help’
/eresa/	ereesa	‘give birth/carry on the back’
/ereka/	ereeka	‘be born’
/ikala/	ikaala	‘sit’
/iva/	iiva	‘hear’
/omala/	omaala	‘dish up ugali’
/ogedha/	ogeedha	‘frighten’
/umbika/	umbiika	‘be piled up’
/umbadha/	umbaadha	‘pile things up’

The data in 3.1.2 show that when these stems are concatenated with a prefix that ends in an *a*, the two vowels appear to fuse.

(3.1.2)

	Underlying	*Surface*	
/a+a/	/ka-asama/	kaasaama	‘He gaped’
	/ma-vuha ya-ake/	mavuha yaake	‘His/her bone’
	/wa-a-ambidha/	waambiidha	‘They helped’
	/wa-ana/	waana	‘children’
/a+e/	/kabuga ka-enyu/	kabuga keenyu	‘You pl.’s rabbit’
	/u-m-vere ka-eresa/	umvere keeresa	‘The woman gave birth’
	/ma-gutwi ya-edi/	magutwi yeedi	‘good ears’
	/u-a-ereka/	weereka	‘You are being born’
/a+i/	/ma-ino/	meeno	‘teeth’
	/wa-ana wa-etu/	waana weetu	‘our children’

	/ni-a-ikala/	neekala	‘I am sitting’
	/ma-yonda ya-iva/	mayonda yeeva	‘baboons heard’
/a+o/	/wa-zehe wa-ose/	wazehe woose	‘all elders’
	/ka-omala/	koomaala	‘he dished up ugali’
	/chi-wa-ogedha/	chiwoogeedha	‘we frightened them’
	/kahuji a-ka-o/	kahuji aako	‘that (near listener) hawk’
/a+u/	/ni-a-umbika/	noombiika	‘I am piling things up’
	/ka-umbadha/	koombaadha	‘he piled things up’
	/ka-u-mu-gosi/	koomgoosi	‘to the man’
	/wa-a-umbik-isa/	woombikiisa	‘they are piling things up a lot’

The data in 3.1.2 show that when *a* precedes another vowel, the two vowels fuse into a single non-high vowel that is assimilated with the place of articulation of the second vowel ([ee] for front vowels, [oo] for back vowels, and in the case of two /a/’s, a long [aa]).

Fusion only affects situations in which the initial vowel is *a*—the contexts /i-V/ and /u-V/ result in Glide Formation, and it is arguable that the specific contexts /o-V/ and /e-V/ (referring specifically to short vowels) do not occur at the word-formation level. /o-V/ does not seem to occur at all, and /e-V/ only occurs in the context /V-e-V/ (in the reflexive). In these cases, the first vowel and the /e/ are affected by phonological rules, and the resulting long vowel does not trigger any phonological rule. For examples, see 3.1.3.

(3.1.3)

Underlying	*Surface*	
/ka-e-iva/	keeiiva	‘he heard himself’
/si-e-endesha/	seendeesha	‘I drove myself’
/u-a-e-ambadha/	weeambaadha	‘you are helping yourselves’
/a-a-e-iva/	eeiiva	‘he is hearing himself’

Additionally, evidence from post-lexical Fusion[20] indicates that /a+V/ is actually treated differently from /e,o+V/, as seen in 3.1.4.

(3.1.4)

Underlying	*Surface*	
/mu-to u-no/	[ṃto uuno]	‘this river’
/i-chi-suse i-chi-dodo/	[ichisuse ichidoodo]	‘the small scorpion’
/u-mu-pira u-mu-dodo/	[umpiro omdoodo]	‘the small ball’
/i-ny-simba i-no/	[isimbe eno]	‘this lion’

Because it will be independently demonstrated that fusion is the first segmental phonological rule in the rule ordering, it is necessary to write the rule so as to specify that only *a*

[20] See section 4.1.

triggers it. To distinguish *a* from the other four vowels of Mushunguli, it must have a different Height than *i,u* and a different V-PLACE than *e,o*.

The result of fusion is always a non-high vowel—if *a* were a low vowel (i.e. on a lower level of height than *e,o*), then combinations such as /a+i/ → [ee] and /a+u/ → [oo] have no straightforward way of deriving a mid-level height. This implies that in Mushunguli, there is only a two-tier height distinction. The Incremental Constriction Model says the Height of the lowest vowel(s) in a language can be represented as dominating no instances of [closed] (Parkinson: 1996). Therefore, in Mushunguli, the mid (non-high) vowels /a,e,o/ are specified with no [closed] specifications, while the high vowels /i,u/ have one [closed] specifications.

Specifying *a* as non-high distinguishes it from *i,u*, but not from *e,o*. The only remaining way to distinguish these three vowels is to assume each has a different V-PLACE. *e* is specified as [coronal] (meaning "front," generally), while *o* is specified as [dorsal] ("back").

Contemporary phonological theory considers *a* to be a central vowel, meaning it does not have coronal or dorsal specifications. This leaves only [labial] under V-PLACE; however, [labial] generally indicates roundness, and *a* is not a round vowel. Parkinson offers the feature [pharyngeal] to refer to *a*, but specifically states that this analysis only applies to languages where *a* interacts with guttural consonants (1996). As Mushunguli has no guttural consonants, there is no strong evidence to specify *a* as [pharyngeal].

A nearly universal assumption of Feature Geometry is that the features dominated by V-PLACE are privative—i.e. a segment cannot be [+coronal] or [-coronal], but rather the feature [coronal] is either dominated by V-PLACE or is not there at all. Thus, there is no way to specify *a* in a "neutral" sense (i.e. [-coronal, -dorsal]). If *a* cannot be classified with the privative features coronal, dorsal, labial, or pharyngeal, and binary feature values are not an option, the logical consequence is that *a* must be classified as placeless.

One might be tempted to represent placelessness as a V-PLACE node that dominates nothing, similar to how a non-high vowel in the language is represented by a Height node with no instances of closed. The difference lies in what the rule formalizations are supposed to represent. As previously stated, all vowels in Mushunguli have a phonological Height, and this is represented by the inclusion of the Height node even when it dominates no instances of [closed]. In short, the empty Height node does not mean that non-high vowels are heightless.

Using this representational logic, including an empty V-PLACE node to represent *a* would imply that *a* is a vowel with some place feature that is not currently part of unified feature theory. It completely misses the generalization that *a* is placeless, not a segment with an undiscovered place feature. The only way to represent this is to specify *a* as completely lacking a V-PLACE node. Note that this does not mean that phonetically, *a* has no place of articulation—phonetically, [a] is a mid, central vowel. However, *phonologically a* has no V-PLACE in Mushunguli.

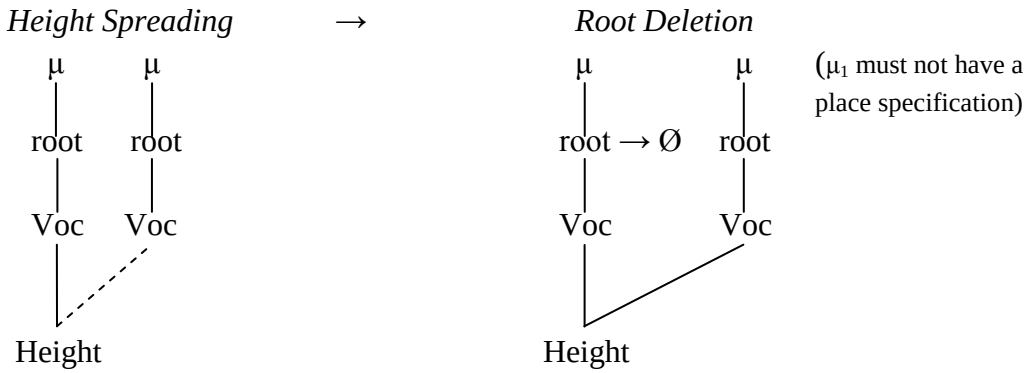
The problem with this analysis is that standard, restrictive rule formalism does not allow negative existential statements. Rules propose that if some *x* (containing a list of properties) exists, *y* occurs. In the case of Fusion, the *x* that exists specifically does *not* contain a property,

and there is no way in standard rule formalism to represent this. But as has been seen, the only way to represent *a* as distinct from *e,o* is to refer to the fact that *a* does not have a V-PLACE. This requires a break with standard rule formalism, with the understanding that allowing negative existential statements open up a whole series of issues. However, alternatives such as a return to binary features or proposing [pharyngeal] are not considerably cleaner.

It is possible to omit structure in a rule that can be predicted by convention. When formulating the rule of Fusion, structure omitted in this way must somehow be distinguished from structure that does not exist. For the reasons discussed above, there is no abbreviation that means "X is lacking" in rule formalism. The only way to do so is use a comment line in the rule. This is the strategy that will be used to represent the Fusion rule, with the understanding that its reliance on a negative existential condition is theoretically imperfect. The phonological status of central vowels and whether negative existentials should be allowable are topics that need to be researched more fully.

Outside of issues of representation, the formalization of vowel fusion is additionally complicated by the fact that there are two ways to write it. The first is a two-step process, in which the height node of *a* first spreads to the second vowel, and then the rest of the *a* is deleted. This would require two rules, formalized in 3.1.5.

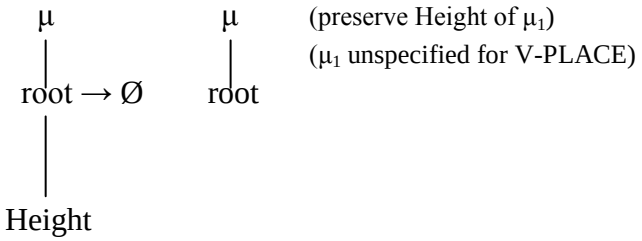
(3.1.5) *Two-Step Fusion*



In these rules, note that V-PLACE is explicitly lacking from the first vowel, while in the second vowel V-PLACE is merely not specified. This is to indicate that the second vowel can be any vowel. The surface vowel will acquire the second vowel's V-PLACE because the initial [a] has been deleted.

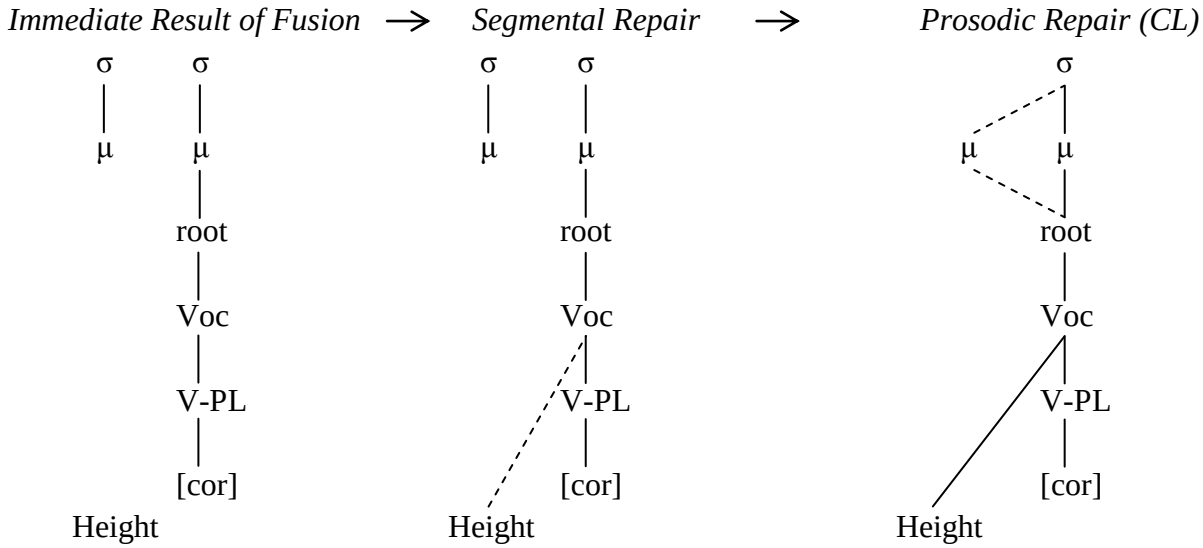
A one-step analysis of Fusion is also possible, using a mechanism for deletion with constituent preservation. That is, the initial segment is deleted, but its Height node is preserved. There is no standard notation within the framework of Feature Geometry to represent this. This is represented by adding another comment line. The rule is given in 3.1.6.

(3.1.6) *One Step Fusion*



After the rule applies, automatic repair processes produce the surface form. The "floating" Height that remains cannot remain unattached to a root. A segmental repair occurs, in which the computational apparatus thus docks the floating Height node to the second vowel, and its status ('not high') becomes the Height of the resulting vowel. Additionally, the prosodic repair process of Compensatory Lengthening (discussed in section 1.4) occurs as well. The resulting segment is a long vowel with the height of the first vowel and the place specification of the second. The derivation of a simple example, /ka-iva/ → [keeva] 'he/she heard' is given in 3.1.7. In this derivation, I include the second vowel's V-PLACE to show how the rule's output uses it.

(3.1.7) *One-Step Fusion Derivation*



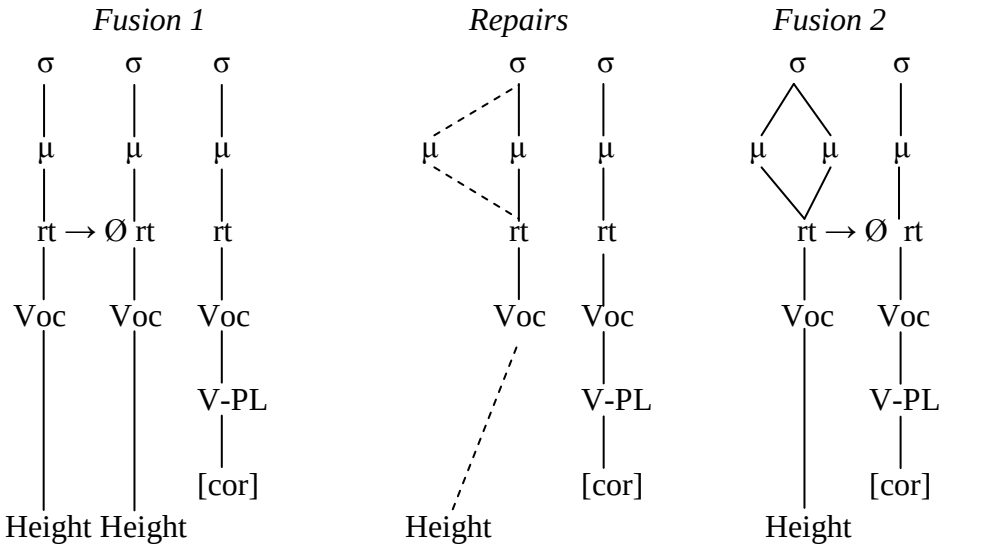
Choosing the correct analysis is complicated. The two-step analysis does not require us to add an additional mechanism to the theory. Assuming that adding constituent preservation is allowable and necessary means the one-step analysis is simpler (in that one rule is simpler than two rules). To resolve this dispute, I examine another Bantu language—Kimatuumbi.

Odden's analysis of Kimatuumbi vowel fusion, which, like in Mushunguli, merges /ai, au/ into [ee, oo] is a one-step solution requiring a constituent preservation condition. This is because Kimatuumbi vowel fusion is optional (Odden: 1996). If the process were governed by a two-step rule, one would expect that both rules would be optional, and that a surface form without the total assimilation of the initial /a/ could arise. For example, /a+u/ could surface as *[ao] or [oo]. The form *[ao], however, does not exist. Fusion either happens, resulting in [oo], or it doesn't, resulting in [au]. As such, Kimatuumbi must use the one-step solution.

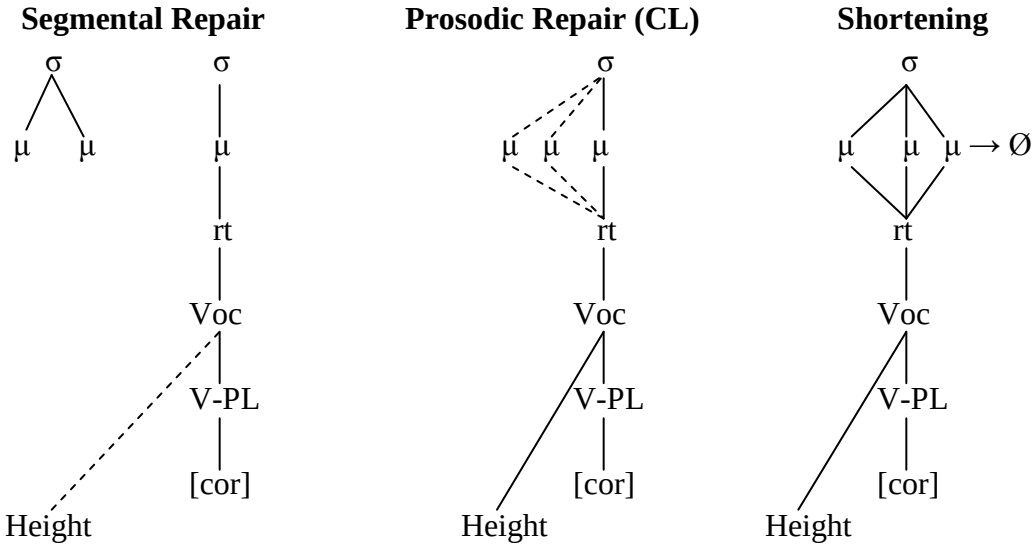
In Mushunguli, Fusion is not optional, which means a one-step solution is not compelled. However, one rule (plus repairs) is simpler than two rules (plus repairs). The one-step solution is further motivated by the assumption the attested rule in Kimatuumbi is representative of the fusion process in all languages—i.e. that fusion, in general, is a one-step process, not a two-step one.

Fusion is the only phonological rule involving contiguous vowel sequences in Mushunguli that can be shown to be iterative—that is, any number of /a/ before another vowel will reduce to a single sound. For example, /wa-a-iva/ → [weeva] 'they are hearing,' not *[waeeva]. Fusion iterates left-to-right, and that once the derived result is no longer any number of [a], the rule can no longer apply. Although prosodic repair processes could theoretically force more than two moras into a syllable as a result of these processes, any instance of more than two moras in a single syllable will result in shortening (discussed in section 1.4). The derivation of [weeva] is given in 3.1.8 to illustrate how Fusion iterates. The "Repairs" step combines segmental and prosodic repairs into the same step, since they are automatic and it does not matter what order they apply in. In the second iteration, compensatory lengthening is separated from the segmental repair, to more clearly illustrate how it creates the context for the rule of shortening.

(3.1.8) *Iterative Fusion*

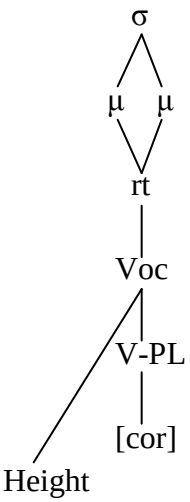


w (a) a i va w aa i va w (aa) i va



w e va w e e e va w e e (e) va

Result



w e e va

3.2 Glide Formation

In 3.2.1, a paradigm of several high-vowel-final past tense subject prefixes and verbal stems is given. Observe the difference in the surface form of the subject prefix when it precedes a vowel-initial root versus a consonant-initial root.

(3.2.1)	*Verb*	*Cl 3 SP (u-)*	*Cl 9 SP (i-)*	*2nd sg. past (ku-)*	
	/lima/	uliima	iliima	kuliima	‘farm’
	/asama/	waasaama	yaasaama	kwaasaama	‘gape’
	/ereka/	weereeka	yeereeka	kweereeka	‘be born’
	/itanga/	wiitaanga	iitaanga	kwiitaanga	‘call’
	/ogera/	woogeera	yoogeera	koogeera[21]	‘swim’
	/umbika/	uumbiika	yuumbiika	kuumbiika	‘pile things up’

Based on the data in (3.2.1), high vowels become glides when followed by another vowel. In the case of two adjacent identical vowels, the resultant glide is deleted via a rule of homorganic glide deletion (see sections 3.3 and 4.4).

This alternation is extremely general—it happens in all word formation contexts. In (3.2.2), examine Glide Formation within the noun phrase.[22]

[21] *o*-initial stems delete glides in the context /CG+o/; see section 3.5.
[22] Data motivating the underlying shapes of these prefixes were given in Chapter 2.

(3.2.2)	*Underlying*	*Surface*	
Possessives	ṃnthu yu-angu	ṃnthu ywaangu	‘my person (cl.1)’
	ṃti u-etu	ṃti weetu	‘our tree (cl. 3)’
	miti i-awo	miti yaawo	‘their trees (cl 4)’
	mbwa i-ako	mbwa yaako	‘your (sg) dog (cl 9)’
	vinkho vi-awo	vinkho vaawo[23]	‘their elbows (cl 7)’
	chinkho chi-enyu	chinkho cheenyu	‘you pl.’s elbow (cl 8)’
	ukhunde u-ake	ukhunde waake	‘his/her bean (cl 14)’
Demonstratives	ṃvere u-yu-o	ṃvere uuyo	‘that (near listener) woman’
	ṃti u-u-o	ṃti uuwo	‘that (near listener) peanut’
	miti i-i-o	miti iyo	‘those (n.l.) peanuts’
	chitungulu i-chi-o	chitungulu iicho	‘that (n.l.) onion’
	vitungulu i-vi-o	vitungulu iivo	‘those (n.l.) onions’
	mbwa i-i-o	mbwe eyo	‘that (n.l.) dog’
	mbwa i-zi-o	mbwe ezo	‘those (n.l.) dogs’
	uta u-u-o	uto owo	‘that (n.l.) bow’
‘All/the whole’	ṃzehe yu-ose	mzehe yoose	‘the whole elder’
	ṃsale u-ose	msale woose	‘the whole arrow’
	misale i-ose	misale yoose	‘all arrows’
	chiga chi-ose	chiga choose	‘the whole leg’
	viga vi-ose	viga voose	‘all legs’
	nguluwe i-ose	nguluwe yoose	‘the whole pig’
	nguluwe zi-ose	nguluwe zoose	‘all pigs’
	uchiza u-ose	uchiza woose	‘all darkness’
	kuja ku-ose	kuja koose	‘all eating’

Glide formation additionally occurs with object prefixes, as seen in (3.2.3).

(3.2.3)	Underlying	Surface	
	si-u-aza	siwaaza	‘I lost it (cl 3)’
	si-u-iva	siwiiva	‘I heard it (cl 3)’
	si-i-aza	siiaaza	‘I lost them (cl 4)’
	si-i-iva	siiva	‘I heard them (cl 4)’
	si-ku-aza	sikwaaza	‘I lost you’
	wa-chi-aza	wachaaza	‘They lost us’
	si-mu-aza-ni	simwaazaani	‘I lost you pl.’

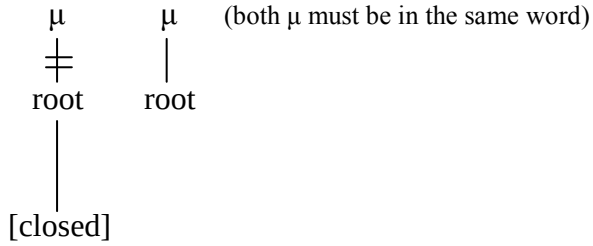
[23] Post-consonantal y-deletion is explained in section 3.4.

ka-ni-enega	kaneeneega	‘He avoided me’
ka-ni-eresa	kaneereesa	‘She carried me on her back’
wa-chi-ogohedha	wachoogoheedha	‘they scared us’
ka-mu-onkedha	kamoonkeedha	‘she suckled you pl.’

It is apparent that glide formation is an extremely general process in Mushunguli—any time a high vowel precedes another vowel, glide formation will occur. Additionally, the glide formation process feeds other rules, such as post-consonantal *y*-deletion as, seen in the example /ka-ni-ega/ → [kaneega].

In Mushunguli, glides are effectively high vowels that are attached directly to the syllable rather than to a mora. Thus, Glide Formation can be represented by a de-linking of a high vowel’s root node from the mora, as illustrated in (3.2.4).

(3.2.4) *Glide Formation*



The requirements of this rule are only that the root is de-linked from the node. The only non-high vowel that appears in a V-V context in Mushunguli is *e*, in the reflexive. The data in 3.2.5 implies that it does not undergo Glide Formation.

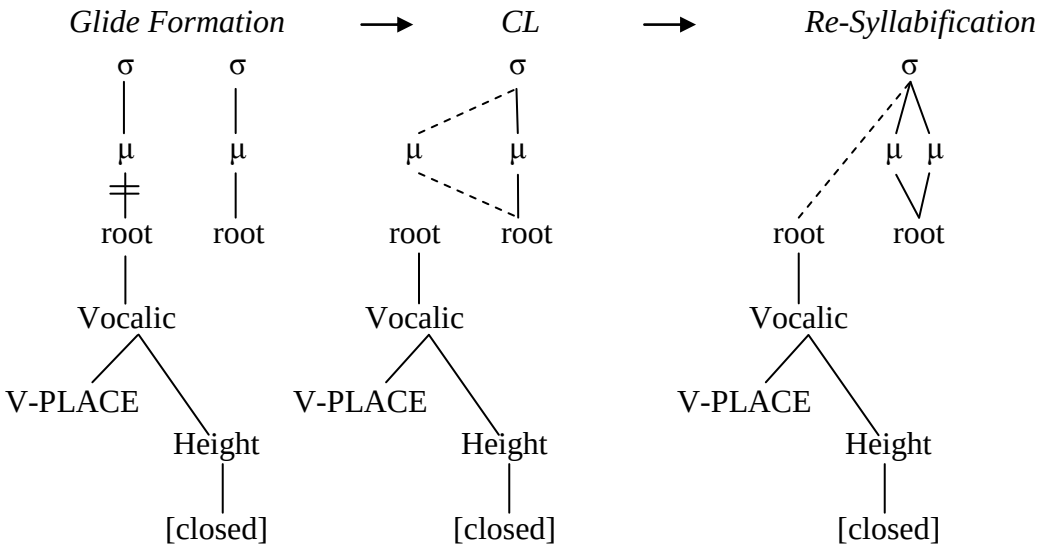
(3.2.5)	*Underlying*	*Surface*	
	ka-e-iva	keeiiva	‘He heard himself’
	si-e-ambidha	seeambiidha	‘I helped myself’
	chi-e-ihidha	cheeihiidha	‘we neglected ourselves’
	ku-e-wudha	kweeuudha	‘you asked yourself’

Based on this evidence, I prefer to write the rule of Glide Formation as referring to only high vowels. If data were to surface showing that non-high vowels also cause glide formation, the rule would have to be adjusted accordingly—however, no such data currently exists.

Moras in Mushunguli must be connected to both a syllable and a root. Additionally, Mushunguli tends to preserve moras unless there are more than two attached to a syllable. Thus, the result of Glide Formation must undergo a re-syllabification process. The rootless mora is delinked from the syllable, which causes the destruction of the syllable node. The mora then attaches itself to the syllable and root nodes of the triggering vowel, resulting in a lengthened vowel (Compensatory Lengthening). Finally, a root node cannot remain unattached to a syllable,

so it attaches itself to the onset of the following syllable. An illustration of these repair processes is given in 3.2.6.

(3.2.6) *GF-Induced Compensatory Lengthening and Re-Syllabification*



3.3 Homorganic Glide Deletion

The data in table 3.3.1 illustrate the normal behavior of high-vowel initial stems in Mushunguli with regards to Glide Formation and Fusion. Note that there is only one example of an *u*-initial verb—this is because there are very few *u*-initial verbs in the language.[24]

(3.3.1)	*Stem*	*Imperative (bare)*	*Infinitive (ku-)*	*3rd sg. Past (ka-)*	
	/iva/	iiva	kwiiva	keeva	'hear'
	/idha/	iidha	kwiidha	keedha	'come'
	/ikala/	ikaala	kwiikaala	keekaala	'sit'
	/ingira/	ingiira	kwiingiira	keengiira	'enter'
	/itanga/	itaanga	kwiitanga	keetaanga	'call'
	/itika/	itiika	kwitiika	keetiika	'respond'
	/umbadha/	umbaadha	kuumbaadha	koombaadha	'pile things up'

[24] It is actually questionable whether there are *any* u-initial verbs in the language. ʔ/umbika/ and ʔ/umbadha/ are the only two potential candidates, because of multiple tokens where they undergo fusion, e.g. [woombiika] 'they are being piled up' and [koombadha] 'he piled things up.' However, there are also tokens of these verbs behaving as if they were C-initial as well, e.g. [waumbiika] and [waumbaadha]. The example of ʔ/umbadha/ is included in 3.3.1 for the sake of discussion, but should be examined with this in mind.

The data presented in 3.3.1 make it clear that high-vowel-initial verb stems undergo fusion and glide formation when the appropriate triggering context is present. Additionally, the imperative form, which is bare, appears to determine the correct underlying forms. However, in table 3.3.2, there are several verbs which appear to have initial high vowels in in the imperative form. Additionally, all of these verbs cause glide formation normally. However, none of these verbs are affected by fusion.

(3.3.2)

Imperative	*Infinitive*	*1st pl. past*	*3rd Sg. Past*	
iiha	kwiiha	chiiha	kaiiha	'be angry'
iita	kwiita	chiita	kaiita	'go'
iimba	kwiimba	chiimba	kaiimba	'sing'
iira	kwiira	chiira	kaiira	'cry'
uusa	kuusa	chuusa	kauusa	'take out'
uumba	kuumba	chuumba	kauumba	'mould'
uguula	kuuguula	chuuguula	kauguula	'lament'
uunga	kuunga	chuunga	kauunga	'want'
uuya	kuuya	chuuya	kauuya	'come back'
uudha	kuudha	chuudha	kauudha	'ask'
uguudha	kuuguudha	chuuguudha	kauguuza	'care for a sick person'
uyuusa	kuuyuusa	chuuyuusa	kauyuusa	'revive'

It is apparent that something about the underlying form of these stems is different than the ones introduced in 3.3.1—otherwise they would undergo fusion. For example, if the underlying form of 'he went' is */ka-ita/, one would expect that the surface form would be *[keeta]. As seen in 3.3.2, the correct surface form is [kaiita]. At the same time, at some point there must exist an intermediate form that is vowel-initial, because glide formation (and subsequent post-consonantal y-deletion, discussed in section 3.4) occurs normally.

There is the possibility that there is some kind of empty segment, which is easier to represent in CV phonology (Clements: 1983) than moraic phonology. In moraic phonology, vowels are generally represented as root nodes attached to moras, while consonants are represented as root nodes attached directly to the syllable. CV phonology does not have the mora tier and simply represents vowels as V and consonants as C, with the appropriate segments or featural content attaching directly to them. Although moraic phonology could also represent an empty C by simply using a root node attached to a syllable, this is less clear than CV phonology, as this also means "any consonant."

Adopting a CV analysis would make it possible to say that there is an empty C at the beginning of the underlying forms of these verbs. That is, */ita/ is really /()ita/, and would be represented as:

(3.3.3) C V C V
i t a

If this is the case, one could simply introduce a rule to delete an empty C between vowels, and this rule would counter-feed Fusion and feed Glide Formation.

There are two reasons why this analysis is not adopted. First, it requires switching theories for one rule. Second, empty Cs are not commonly attested—there is a possible example in Kikamba, where there are a series of stems that fail to undergo several phonological rules (Roberts-Kohno: 2000). However, adopting this abstract approach does not pose any advantage, as this issue can be resolved using normal segments that are already attested in the language.

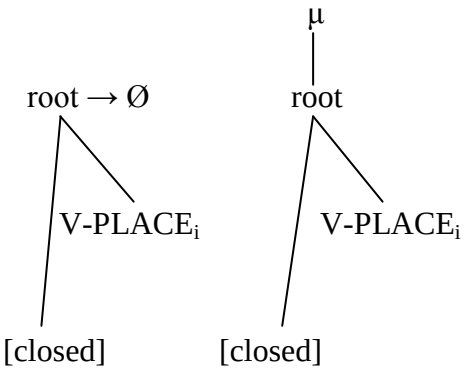
A more preferable analysis would remain in the realm of moraic phonology, be more commonly attested (if possible), and capture the similarities among these verb stems. This is possible if two assumptions are made. First, the seemingly vowel-initial stems actually begin with a glide and a vowel whose places of articulation are homorganic—i.e. /yi/ and /wu/. Note that nowhere in Mushunguli do *[yi] or *[wu] ever actually surface. Second, these glides are deleted by a rule of Homorganic Glide Deletion, a process which is attested in both Kimatuumbi (Odden: 1996) and Makonde (Liphola: 2001), albeit in different contexts. This would mean the actual underlying forms of these verbs are the ones in 3.3.4.

(3.3.4)

/yiha/	‘be angry’	/wugula/	‘lament’
/yita/	‘go’	/wunga/	‘want’
/yimba/	‘sing’	/wuya/	‘come back’
/yira/	‘cry’	/wuza/	‘ask’
/wusa/	‘take out’	/wuguza/	‘care for a sick person’
/wumba/	‘mould’	/wuyusa/	‘revive’

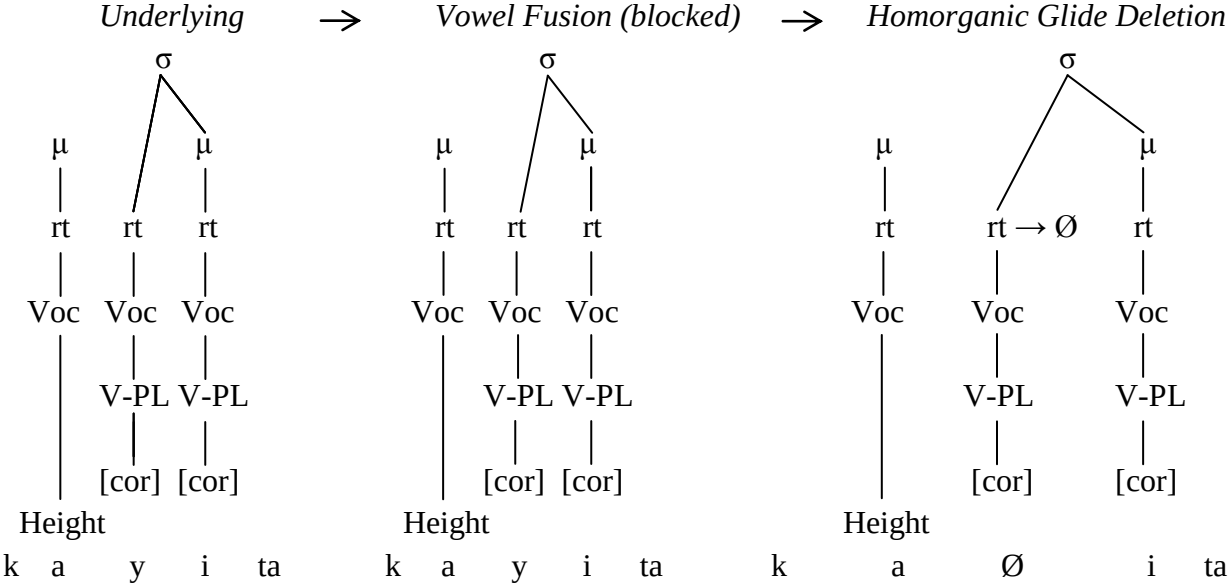
The rule of Homorganic Glide Deletion is given in 3.3.5. In this representation, vowels are differentiated from glides in that they connect to a mora.

(3.3.5) *Homorganic Glide Deletion*

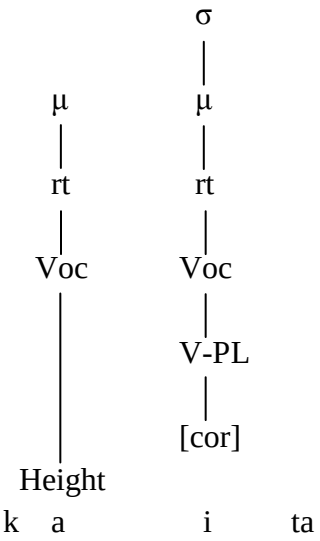


The application of glide formation but not fusion can be explained by simple ordering. Fusion occurs first, then Homorganic Glide Deletion, then Glide Formation. Homorganic Glide Deletion is thus in a counter-feeding relationship with Fusion and a feeding relationship with Glide Formation. A derivation of /ka-yita/ → [kaiita] ‘he/she went’ is given in 3.3.5 to demonstrate the counter-feeding relationship between Vowel Fusion and Homorganic Glide Deletion.

(3.3.5) *Counter-Feeding Derivation*



Result



There seems to be an ordering conflict between this rule and glide formation. This rule feeds glide formation in the case of these glide-initial stems. However, because glide formation is assumed to affect identical high vowel sequences, homorganic glide deletion also appears to be fed by it. For example, the surface form of /i-iva/ 'it (cl.9) heard' is [iiva], not *[yiiva]. Either glide formation does not apply to identical high vowel sequences, or else Homorganic Glide Deletion must apply more than once. This issue is resolved in section 4.4.

3.4 Post-consonantal y-deletion

Glide Formation feeds several glide deletion rules. The most common of these is the deletion of post-consonantal *y*, as was first seen in table 3.2.2 and is further demonstrated in the table in 3.4.1.

(3.4.1)

Underlying	Expected	Surface	
/chi-asa/	*chyaasa	chaasa	'We divorced'
/vi-eresa/	*vyeereesa	veereesa	'They (cl 8) gave birth'
/ka-ni-aza/	*kanyaaza	kanaaza	'He lost me.'
/chisuse chi-ani/	*chisuse chyaani	chisuse chaani	'Whose scorpion?'
/vitungulu vi-ao/	*vitungulu vyaao	vitungulu vaao	'Their onions'
/simba zi-ose/	*simba zyoose	simba zoose	'all lions'
/vinkho vi-edi/	*vinkho vyeedi	vinkho veedi	'good elbows'
/na-ni-ive/	*nanyiive	naniive	'I will hear'
/na-chi-eruse/	*nachyeeruuse	nacheeruuse	'They will relax'
/ni-a-nywa/	*nyaanywa	naanywa	'I am drinking'
/chi-a-guluka/	*chyaaguluuka	chaaguluuka	'They (cl 7) are running'

Contrast these examples with examples of post-consonantal *w* in 3.4.2.

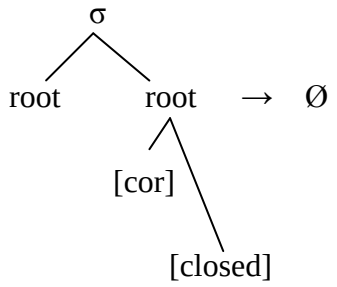
(3.4.2)

Underlying	*Surface*	
/ku-adha/	kwaadha	'to lose'
/ku-eresa/	kweereesa	'to give birth'
/ku-ikala/	kwiikaala	'to sit'
/lu-ayo/	lwaayo	'foot[25]'
/mgosi yu-edi/	mgosi yweedi	'good man'
/mu-ambidha/	mwaambiidha	'you pl. helped'
/mame yu-angu/	mame ywaangu	'my mother'
/mu-edhi/	mweedhi	'month (cl. 3)'
/mu-ana/	mwaana	'child (cl. 1)'

Comparing 3.4.1 and 3.4.2, it becomes apparent that post-consonantal *y* is deleted while *w* is not. This rule is formalized in 3.4.3.

[25] A few words have retained the archaic Class 11 prefix /lu-/; these words take class 9 agreement patterns.

(3.4.3) *Post-consonantal* y*-deletion*



The syllable node is included here to indicate that these two roots are consonants, since there are no moraic segments to compare to. The direct attachment of the featural content under the second root is what distinguishes the glide *y* from the vowel *i*.

3.5 Palatalization

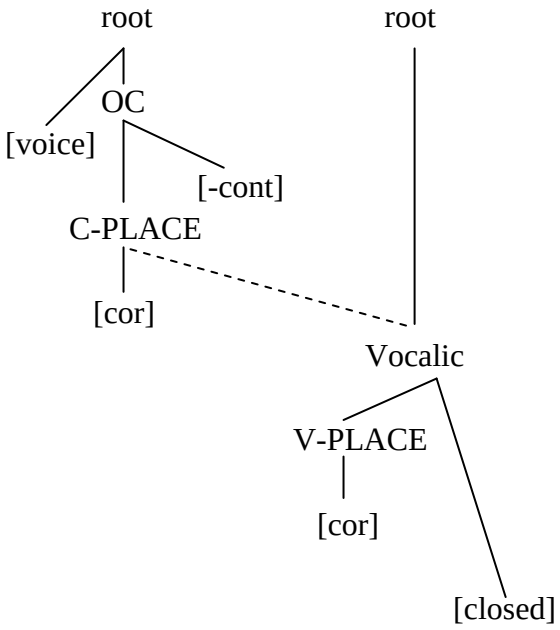
As was seen in 3.4.1, the rule of post-consonantal *y*-deletion appears to be ordered directly after glide formation. However, the data in 3.5.1 shows that there is a context in which an intermediate rule affects the output of glide formation before post-consonantal *y*-deletion applies. The data in 3.5.1 show the effect of this rule—note that all tokens are examples of the Class 5 demonstrative series prefix, /di-/.

(3.5.1)

Underlying	Expected	Surface	
/buku di-no/	buku diino	buku diino	‘this book’
/i-di-yonda i-di-o/	*idiyonda iido	idiyonda iijo	‘that (near listener) baboon’
/vuha di-angu/	*vuha daangu	vuha jaangu	‘my bone’
/yonda di-ako/	*yonda daako	yonda jaako	‘your baboon’
/tope di-ake/	*tope daake	tope jaake	‘his/her mud’
/bambo di-etu/	*bambo deetu	bamboo jeetu	‘our marabou stork’
/jula di-enyu/	*jula deenyu	vuha jeenyu	‘you pl’s frog’
/wata di-ao/	*wata daao	wata jaao	‘their duck’
/gutwi di-ani/	*gutwi daani	gutwi jaani	‘whose ear?’
/bawu di-edi/	*bawu deedi	bawu jeedi	‘good hyena’

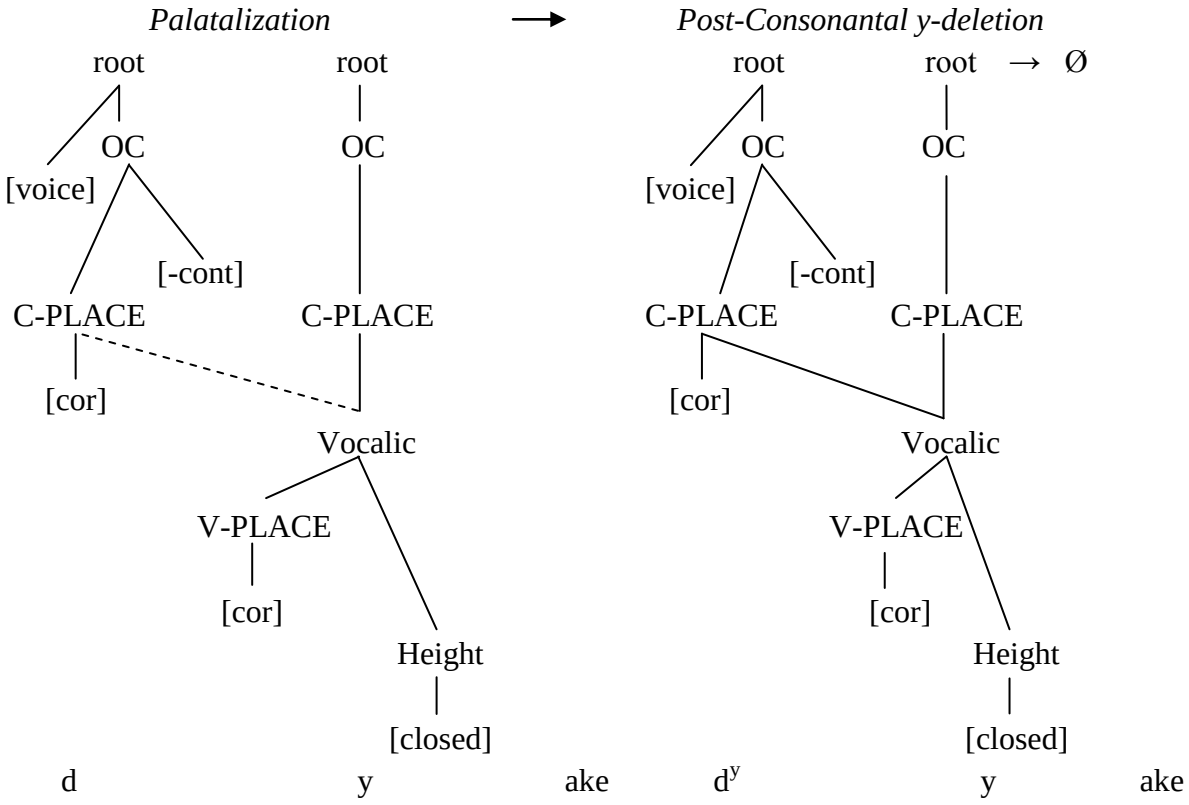
In 3.5.1, that the initial consonant of the prefix is palatalized (written *j* in Mushunguli) before post-consonantal *y*-deletion occurs. There is only evidence that this rule affects the coronal consonant *d*. Derived *ty*-*V* exists in Mushunguli and is affected by a phonological rule For example, /ku-igut-y-a/ → [kwiiguusa] ‘to satisfy tr.’ (c.f. /ku-iguta/ → [kwiiguuta] ‘be sated’). However, this is not an example of palatalization. While derived *sy* clusters are generated in the verb phrase, the *s* never becomes palatalized before the *y* is deleted. The rule of palatalization is given in 3.5.2.

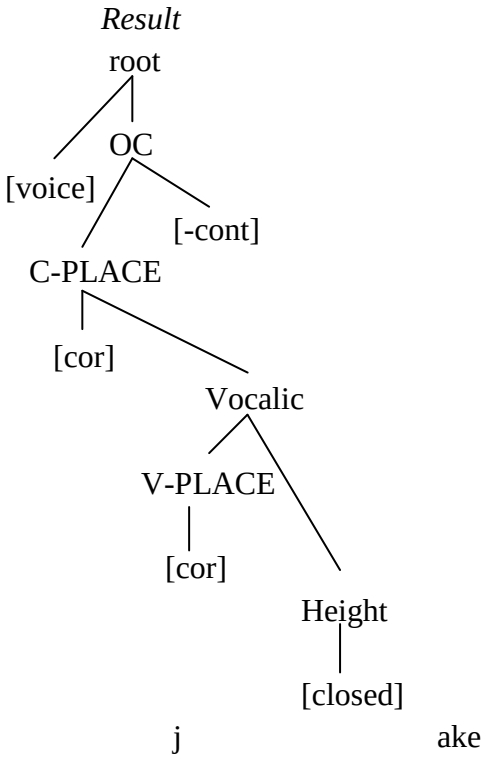
(3.5.2) *Palatalization*



By the rule of Palatalization, the Vocalic node of *y* spreads to *d* before Post-Consonantal *y*-deletion occurs. The Vocalic node and everything it dominates is preserved due to its attachment to *d*, resulting in only a palatalized segment remaining. A sample derivation of the word *jake* 'his/her (Class 5) is given in 3.5.3. The intermediate form of the palatalized *d* is written <d^y>, but the final surface form as <j>. This is just a notational difference—<j> is phonologically a palatalized coronal stop.

(3.5.3) *Palatalization Derivation*





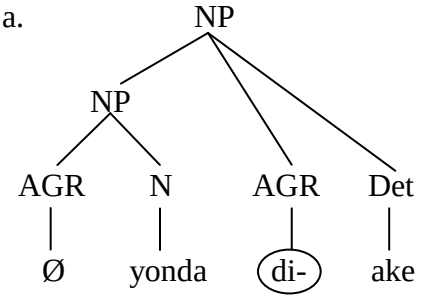
The data in 3.5.4 provide evidence that there are additional categorical restrictions on the rule of palatalization. Specifically, they show that not every instance of a derived *dy* cluster results in palatalization. The rule only affects a derived *dy* cluster when the first phrasal node dominating it is NP.

(3.5.4)	Underlying	Expected	Surface	
Subject				
	/di-a-ambidha/	*jaambiidha	daambiidha	‘It (cl 5) is helping’
	/di-a-ogera/	*joogeera	doogeera	‘it is swimming’
	/di-iva/	*jiiva	diiva	‘It heard’
	/di-erusa/	*jeeruusa	deeruusa	‘it relaxed’
	/na-di-wuye/	*najuuye	naduuye	‘it will come back’
	/na-di-yite/	*najiite	nadiite	‘it will go’
	/bawu di-a-ingira/	*bawu jeengiira	bawu deengiira	‘a hyena is entering’
	/duma di-a-onkedha/	*duma joonkeedha	duma doonkeedha	‘a cheetah is suckling’
	/yonda di-asama/	*yonda jaasama	yonda daasama	‘A baboon gaped’
	/wata di-erekera/	*wata jeerekeera	wata deerekeera	‘a duck floated’
Object				
	/si-di-ohedha/	*sijooheedha	sidooheedha	‘I scared it’
	/ka-di-ambidha/	*kajaambiidha	kadaambiidha	‘he helped it’
	/ni-a-di-amira/	*naajaamiira	naadaamiira	‘I am guarding it’
	/wa-a-di-enega/	*waajeeneega	waadeeneega	‘they are avoiding it’
Preposition				
	/boko di-a-yonda/	*boko jaayoonda	boko daayoonda	‘banana of the baboon’

In 3.5.4, most instances of a *dy* cluster simply undergo Post-Consonantal *y*-deletion. Palatalization only occurs when the first phrasal node dominating the affected prefix is the noun phrase. In 3.5.5, three examples are given. Example (a) shows a context in which palatalization will occur, while examples (b) and (c) shows contexts in which it will not occur.

(3.5.5) *Syntactic Context of Palatalization*

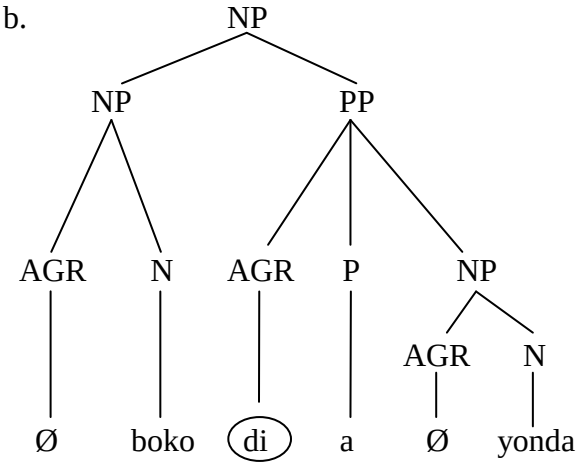
a.



yonda jake

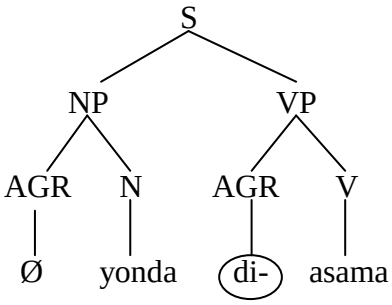
‘his/her baboon’

b.



boko daayonda
‘banana of the baboon’

c.



yonda daasaama
‘a baboon gaped’

The three examples in 3.5.5 do not represent every syntactic structure in which palatalization will or will not occur. However, they illustrate the general pattern. In (b) and (c), the first *phrasal* nodes dominating the agreement prefix that will undergo Glide Formation are PP and VP, respectively. In these cases, palatalization does not occur. In (a), the first phrasal node dominating the prefix is NP, and palatalization occurs.

Indirect reference theory holds that phonology does not have direct access to phonological information. Instead, there is an intermediate level of prosodic structure (“P-structure”), outside of phonology or syntax, which mediates between the two domains (Selkirk: 1986). For example, a phonological rule could assign stress to the first syllable of the first adjective following a head noun. Indirect reference would group the head and its first complement into a P-phrase, and the rule’s formalization would make reference to this unit as a condition of the rule (1986).

Indirect reference theory is attractive because it seems to capture why so many attested syntactically-conditioned phonological rules are prosodic, and works well for prosodic phonological rules involving the relationship between two parts of a syntactic unit. However, it specifically disallows a phonological rule from "knowing" the lexical category of the phrasal projection dominating the affected words or segments (i.e. it cannot know that the phrasal node is an NP versus a VP). It is incapable of describing a relationship like the one that exists in Mushunguli palatalization, because, as seen in 3.5.5, the rule's application is dictated by the lexical category of the first phrasal node.

Adherents of indirect reference theory will be tempted to argue that Mushunguli's palatalization rule is an example of suppletive allomorphy. That is, the Class 5 prefix is /di-/, with allomorphs /Ø-/ on the noun and /j-/ on demonstratives. This would be akin to holding that the 1st singular subject prefix (in general) is underlyingly /ni-/, but has an allomorph in the past /si-/.

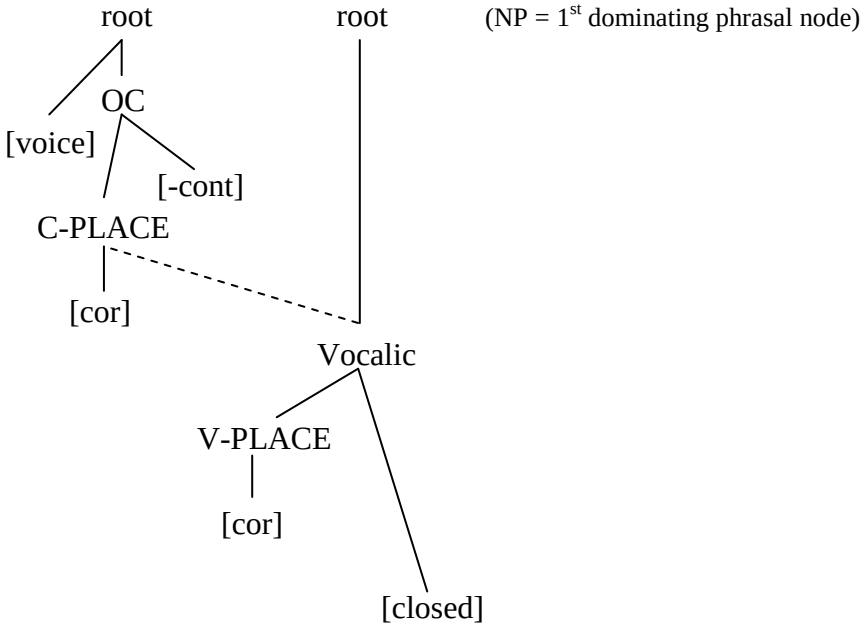
However, the ni/si case is different from the di/j case. The ni/si allomorphs are conditioned only by clear, morphological facts—the prefix /si-/ is always selected in the past tense in the case of a 1st singular subject. [ni-] will never surface in the past, and it will always surface (though sometimes in a slightly altered form, such as in the present) in other tenses. In this case, it is simpler to assume that the allomorph exists.

In the case of di/j, the appearance of *j* is conditioned by the application of Glide Formation. While one could argue that *j* is an allomorph that is selected in cases where Glide Formation would apply, this ignores cases like [daasaama] 'it (cl.5) gaped,' where glide formation applies but the prefix selected is still /di-/. In order to use suppletive allomorphy, a claim has to be made that there are multiple *di* prefixes that are selected for different things, including one that applies to demonstratives such as /-no/ 'this' and /-hi/ 'which.' Only the demonstrative *di* prefix has an allomorph *j* which is selected only in contexts[26] that will be affected by glide formation. Because there are no clear sole phonological or morphological conditions on the rule, the surfacing of [j] is not an example of suppletive allomorphy, but rather a case of a syntactically-conditioned segmental phonological rule. This opens future research questions regarding the relationship between syntactic structure and phonological rules.

There is no shorthand way to indicate "only when the first phrasal node dominating the prefix is NP" in Feature Geometry. Thus, in order to correctly formalize the rule, a comment line is again necessary. The revised formalization is given in 3.5.6.

[26] And *edi* 'good,' which is semantically an adjective, but behaves like a demonstrative in terms of agreement.

(3.5.6) *Palatalization (revised)*



3.6 w-deletion

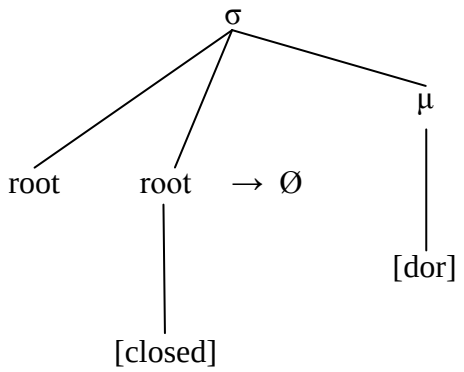
The glide *w* deletes in a narrower range of contexts than *y*. One context in which *w* always deletes is when it follows a consonant and precedes the vowel *o*. The data in 3.6.1 illustrate this context and a comparative context featuring [yo] and [Cyo] clusters.

(3.6.1)	Underlying	Expected	Surface	
wo	/u-ogera/	woogeera	woogeera	'it (cl. 14) swam'
	/mti u-u-o/	mti uuwo	mti uuwo	'that (near listener) tree'
Cwo	/mu-omboka/	*mwoombooka	moombooka	'you pl. went far'
	/ku-ogera/	*kwoogeera	koogeera	'to swim'
	/si-ku-ogedha/	*sikwoogeedha	sikoogeedha	'I scared you'
yo	/simba i-ose/	simba yoose	simba yoose	'the whole lion'
	/miti i-i-o/	miti iiyo	miti iiyo	'those (near listener) trees'
Cyo	/simba zi-ose/	simba zoose	simba zoose	'all lions'
	/chi-ogera/	choogeera	choogeera	'it (cl. 7) swam'
	/ni-a-chema/	naacheema	naacheema	'I am singing'

The formalization of this rule does not specify that the glide *w* is deleted before *o*. There is no way to tell if post-consonantal *y* is deleted by its own rule or this one in cases where it precedes *o*. Since post-consonantal *y* deletes anyway, I prefer the rule that does not restrict the

nature of the glide. As was previously discussed, any instance of *wu* is reduced to [u] by Homorganic Glide Deletion. As such, the height of the triggering vowel does not need to be specified, only the place.

(3.6.2) *o*-triggered Cluster Reduction



w also deletes between vowels, in the context /awa/. This is illustrated by the data in 3.6.3.

(3.6.3)	Underlying	Expected	Surface	
	/m-gosi ka-wambala/	*mgosi kawambaala[27]	mgosi ka.ambaala	'A man was in danger'
	/a-a-wambala/	*aawambaala	a.ambaala	'He is in danger'
	/moroti di-a-wa-dire/	moroti daawadiire	moroti da.adiire	'the moroti that they ate'
	/ni-a-wa-toa/	naawatooa	na.atooa	'I am hitting them'

The resulting disyllabic vowel cluster is distinct from normal long vowels. These strings are transcribed as [a.a] because they consistently have a greater phonetic duration than [aa]. This is similar to Kikamba, where [a.a] is also longer than [aa] (Roberts-Kohno: 200). It is often particularly striking in cases such as [a.ambaala], where the results of fusion can cause compensatory lengthening on the first syllable. Monosyllabic long vowels, which are usually caused by stress assignment or the results of compensatory lengthening, are frequently shortened and can be difficult to distinguish from regular vowels. This is never the case with disyllabic long vowels—even in rapid speech, these vowels are distinguishable from monosyllabic long and short vowels.

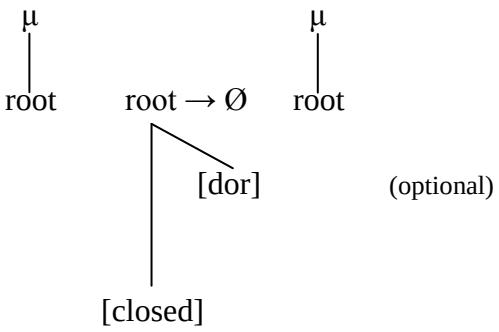
Note from the examples in 3.6.3 that this rule is optional. However, it only seems to apply to underlying /w/ and never ones that are derived from glide formation. For example, /na-u-ogere/ 'You will swim' can only surface as [nawoogeere], never *[na.aogere]. This could be due to an ordering relationship—i.e. intervocalic glide deletion may occur before glide

[27] /wambala/ 'to be in danger' always seems to lose its underlying /w/ intervocalically.

formation, allowing it to affect underlying /w/ but not derived ones. More data is needed to determine if this is the case—for example, comparing class 2 and class 3 subjects in an intervocalic context (e.g. /na-wa-ogere/ vs. /na-u-ogere/). A few tokens of these contexts exist, but not enough to make a conclusive statement, especially about an optional rule.

The optional intervocalic glide deletion rule is given in 3.6.4.

(3.6.4) *Intervocalic Glide Deletion*



3.7 Nasal Syllabification

In Chapter 2, I listed the underlying form of the Classes 1 and 3 prefixes, as well as the 2nd-plural subject and object prefixes as /mu-/, despite the fact that they seem to always surface as either [m̩] or [mw]. However, no explanation for why I chose this underlying form was given. Data comparing these singular prefixes with the corresponding plural classes is given to show the motivation of this analysis. In this table, all Class 1 singulars correspond to Class 2 plurals, and Class 3 singulars correspond to Class 4 plurals.

(3.7.1)	*Singular*	*Plural*	
Classes 1/2	mwaana chiiche	waana chiiche	‘girl’
	mwaana chiruume	waana chiruume	‘boy’
	mwaana	waana	‘child’
	mwaali	waali	‘unmarried female candidate for initiation’
	mwiihwa	weehwa	‘nephew/niece (sister’s child)’
	m̩goosi	wagoosi	‘man’
	m̩veere	waveere	‘woman’
	m̩baavi	wabaavi	‘thief’
	m̩dhehe	wadhehe	‘elder’
Classes 3/4	mwiiri	miiri	‘body’
	mwiira	miira	‘song’
	mweezi	meezi	‘month’
	m̩ti	miiti	‘tree’
	m̩to	miito	‘river’

ṃnyaawu minyaawu ‘cat’

Examining this paradigm, it becomes apparent that the underlying form of the Classes 1 and 3 prefixes does not seem to ever surface unchanged. The lengthening of the first *a* in examples such as [mwaana chiruume] ‘boy’ indicate that something phonological has occurred to cause compensatory lengthening.

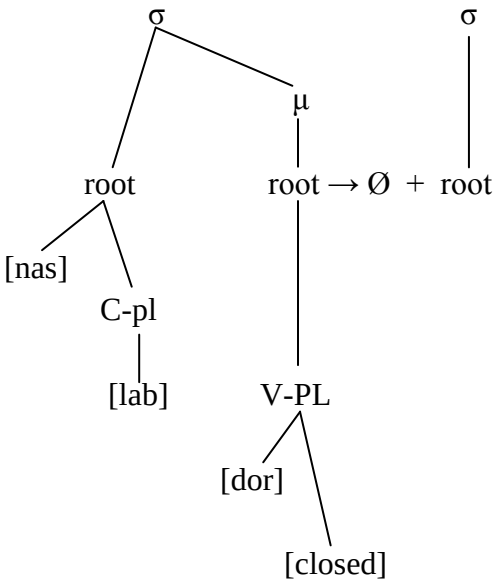
A similar pattern emerges with the 2nd person plural subject and object prefixes, /mu-/. A few examples are given in 3.7.2.

(3.7.2)

[ṃja]	‘you pl. ate’
[ṃnywa]	‘you pl. drank’
[mwiiva]	‘you pl. heard’
[mwaasa]	‘you pl. divorced’
[simtooa]	‘I hit you pl.’
[wamtooa]	‘They hit you pl.’
[simwiiva]	‘I heard you pl.’
[kamwaadha]	‘He/she lost you pl.’

In previous sections, I have listed the underlying form of these prefixes as /mu-/. This is because it is the easiest way to explain the unusual distributions, with the fewest number of additional rules. The rule is very specific—in a morpheme shaped like /mu-/, the *u* is deleted when it is attached to a C-initial stem. The rule for /mu/ reduction is given in 3.7.3.

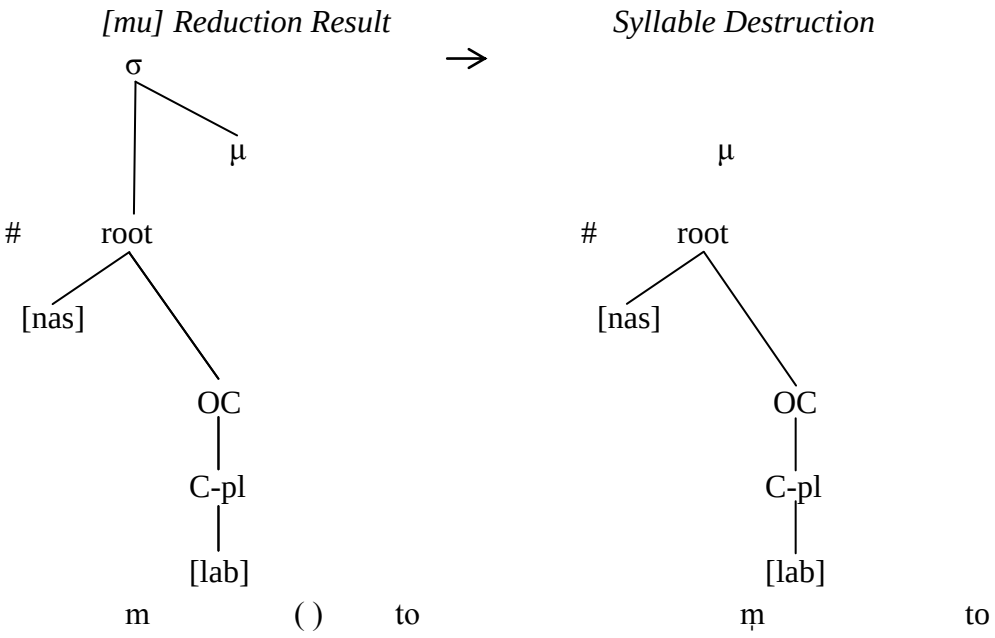
(3.7.3) */mu/ Reduction*



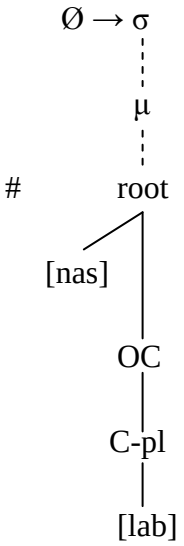
The deletion of *u* causes the first syllable node to be destroyed. When the nasal is utterance-initial, its root attaches to the remaining mora, and repair processes create a new syllable, whose nucleus is [m̩]. Otherwise, it generally ends up in the coda of the preceding syllable, such as in /mu-nthu mu-kulu/ → [m̩nthumkulu] ‘big man.’ In either case, the nasal remains directly attached to the syllable as well as to the mora, meaning it remains in the onset as well. If /mu-/ is attached to a V-initial stem, Glide Formation applies, changing the /u/ to a [w].

3.7.4 gives a derivation of /mu-to/ → [m̩to] ‘river,’ showing how the nasal syllabifies.

(3.7.4) *Nasal Syllabification*



Syllabification



The alternate analyses for the underlying form of these prefixes would be /m̩-/ or /mw-/. However, both of these analyses are ultimately more complicated than assuming /mu-/. If the underlying form is assumed to be /m̩/, then two rules are necessary: a rule to insert a [w] when it precedes a vowel, followed by a rule to de-syllabify the nasal afterwards. The resulting length on the vowel (i.e. in [mwaana]) could be caused by Compensatory Lengthening, though it would require the mora from the nasal to somehow ignore the *w*.

If the underlying form is assumed to be /mw/, then preceding C-initial stems, the /w/ must first be deleted, and the nasal must then be syllabified. However, unlike in the preferred analysis, a mora must be inserted to syllabify the nasal, as there are no floating moras to use.

All of the possible underlying forms require similarly complicated analyses, with /mw-/ perhaps being the least attractive due to having to insert a mora. I choose /mu-/ because of a similar alternation with the copula, /ni-/. /ni-/ can be reduced in the same way as /mu-/, exemplified by the example [nikwerekweche] ~ [n̩kwerekweche] ‘it’s a francolin.’ Unlike the reduction of /mu-/, this rule seems to be optional, but would look very similar.

Chapter 4: Post-lexical Phonological Rules

The bulk of this research was done on word-level interactions. This chapter is included with the caveat that considerably more research can and needs to be done on phonological alternations between words. That said, this chapter will describe and give examples of instances where the phonological rules from Chapter 3 apply to the phrasal level. Additionally, it will propose phrasal-specific rules where they seem necessary.

4.1 Post-lexical Fusion

Fusion can occur between words that end with an [a] and begin with another vowel. However, this only occurs if a word-level phonological rule does not apply first. For example, /mitedha i-ose/ 'all peanuts' seems to provide the correct context—however, word-level Glide Formation first affects /i-ose/, changing it to [yose] and thus destroying the context in which Fusion could have applied. It is unclear whether or not this differs from the word-formation level, because although /a-i-V/ or /a-u-V/ sequences are definitely possible to generate in Mushunguli, no examples of them were elicited. However, I predict that these sequences would result in [eeV] and [ooV], respectively, because lexical Vowel Fusion occurs before lexical Glide Formation, as illustrated by the glide-initial stems discussed in section 3.3 (e.g. /ku-yimba/ → [kwiimba] 'you sang,' but /ka-yimba/ → [kaiimba] 'he/she sang'). Vowel Fusion can only apply if a consonant immediately follows the first vowel of the second word, such as the examples in 4.1.1, which use the verb /toa/ 'hit' and a direct object.

(4.1.1)	*Underlying*	*Surface*	
	/si-toa u-muti/	[sitooṃti]	'I hit the tree'
	/si-toa i-miti/	[sitoeemiiti]	'I hit the trees'
	/si-toa i-vinkho/	[sitoeeviinkho]	'I hit the elbows'
	/si-toa i-nybwa/	[sitoeembwa]	'I hit the dog'
	/si-toa i-zimbwa/	[sitoeeziimbwa]	'I hit the dogs'
	/si-toa a-katumbiri/	[sitoaakatumbiri]	'I hit the vervet'

Length of the utterance does not matter, as seen in 4.1.2.

(4.1.2)	*Underlying*	*Surface*	
	/si-inkha i-di-yonda boko/	[siinkheediyonda boko]	'I gave the baboon a banana'
	/si-inkha a-ma-yonda ma-boko/	[siinkhaamayonda mabooko]	'I gave the baboons bananas'
	/chi-nkha i-chi-bonkho nkhande/	[chinkheechiboko nkhaande]	'We gave the hippo food'
	/si-nkha i-vi-bonkho	[sinkheevibonkho	'I gave the hippos food'

nkhande/ nkhaande]

It is not necessary to rewrite the rule of Vowel Fusion to reflect its application between words. While it will not apply in the context /a # VV/, this is simply due to another phonological rule applying at the word-formation level first.

4.2 Post-Lexical Glide Formation

Glide Formation does not occur at the phrasal level. Contexts in which Glide Formation is expected to occur but fails to are given in 4.2.1.

(4.2.1)

Underlying	*Expected*	*Surface*	
/muti u-hi/	*[ṃtyuuhi]	[ṃti uuhi]	‘which tree’
/muti u-gwa/	*[ṃtyuugwa]	[ṃti uugwa]	‘a tree fell’
/ulimi u-vunika/	*[ulimyuuvuniika]	[ulimi uvuniika]	‘a tongue broke’
/buku i-di-o/	*[bukwiijo]	[buku iijo]	‘that (n.s.) book’
/chitungulu i-chi-o/	*[chitungulwiicho]	[chitungulu iicho]	‘that (n.s.) onion’

The data in (4.2.1) only features high vowels preceding other high vowels. The shape of Mushunguli agreement prefixes makes it very difficult to generate a phrase-level context of high vowel before *a*, and impossible to generate high vowel before *e,o*. Despite this, I can state with some confidence that Glide Formation does not appear to apply between non-identical high vowels. Additionally, like lexical Glide Formation, it is impossible to determine whether or not it applies to identical high vowels, as seen in 4.2.2.

(4.2.2)

Underlying	*Surface*	
/miti i-no/	[miti.ino]	‘these trees’
/miti i-ja/	[miti.ija]	‘those (n.l.) trees’
/miti i-hi/	[miti.ihi]	‘which trees’
/i-miti i-gwa/	[imiti.igwa]	‘the trees fell’
/ni-wajibu uhinye/	[ṇwajibu.uhiinye]	‘you should teach’[28]

Although Glide Formation applies to identical high vowels at the level of word-formation, if there is a word boundary between the two vowels, Glide Formation does not occur.

[28] This sentence comes from Dave Odden’s data set.

4.3 Intervocalic Glide Deletion

There is some evidence for phrase-level intervocalic glide deletion. Like in the word-level rule, this rule also appears to be optional, and situations where identical vowels precede each other seem to create super-long vowels. Examples are given in 4.3.1.

(4.3.1)					
	/uta u-angu/	uta waangu	~	uta.angu	‘my bow’
	/utumbo u-ako/	utumbo waako	~	utumbo aako	‘your intestine’
	/utumbo u-ake/	utumbo waake	~	utumbo aake	‘his/her intestine’
	/muiko u-ako/	mwiko waako	~	mwiko aako	‘your ladle’
	/muiko u-ake/	mwiko waake	~	mwiko aake	‘his/her ladle’
	/musango u-angu/	ṃsango waangu	~	ṃsango aangu	‘my sand’
	/musango u-ako/	ṃsango waako	~	ṃsango aako	‘your sand’
	/musango u-ake/	ṃsango waake	~	ṃsango aake	‘his/her sand’
	/wanthu wa-etu/	wanthu weetu	~	wanthu eetu	‘our people’
	/wanthu wa-ose/	wanthu woose	~	wanthu oose	‘all people’
	/mitedha i-etu/	mitedha yeetu	~	mitedha eetu	‘our peanuts’

This rule behaves the same in both word-formation level and phrase-level contexts, and as such does not need to be modified. However, it is worth noting that post-lexically, derived [w] can be deleted, not just underlying /w/. Also, it is interesting that *w*-deletion appears to occur in a wider range of contexts than at the word-formation level. This is likely because a greater variety of VGV contexts occur at this level.

4.4 Post-lexical Homorganic Glide Deletion

In section 3.3, it was mentioned that lexical Homorganic Glide Deletion has an ordering conflict with Glide Formation. Homorganic Glide Deletion feeds Glide Formation in situations where there are underlying glide-vowel sequences /yi/ and /wu/. This allows glide-initial verbal stems to undergo Glide Formation—for example, /ku-yita/ → [kwiita] ‘you went.’ However, there is an assumption that Glide Formation is completely general—it affects all underlying high vowel-vowel sequences at the word formation level. By necessity this must include identical high vowel sequences. Because Homorganic Glide Deletion is ordered before Glide Formation, one should expect to see derived [yi] and [wu] sequences at the surface. However, this does not generally occur—for example, /i-iva/ → [iiva] ‘it (cl. 9) heard,’ not *[yiiva].

One solution would be to propose that Glide Formation does not affect these identical high vowel sequences. This makes the rule of Glide Formation considerably less generalizable and very difficult to formalize without something like the –α notation used in SPE phonology to indicate “not the same.”

Instead of needlessly complicating the rule, I instead propose a separate, post-lexical rule of Homorganic Glide Deletion. This rule affects derived glides after all lexical rules have

occurred, and does not feed into any other parts of the phonology. It simply accounts for the pronunciations. Additionally, there are some situations in which the appearance of glides is unclear—for example, the word for ‘hyena’ could be [bau] or [bawu], since there is no distinction between the two and both transcriptions are phonetically plausible given the range of pronunciations in the language. More research is needed to see if syllable position or optionality factors into Homorganic Glide Deletion in Mushunguli.

Chapter 5: Conclusion

In this work, I have described to the fullest of my ability the vocalic phonology of Mushunguli. It is possible and likely that additional phonological rules exist, particularly those involving interactions between consonants and prosody. The rules found include lexical and post-lexical Fusion, Glide Formation, Post-Consonantal *y*-deletion, Palatalization, Homorganic Glide Deletion, *o*-triggered Glide Deletion, /mu/-reduction and nasal syllabification, and optional lexical and post-lexical Intervocalic Glide Deletion. Additionally, observations regarding syllable structure and vowel length were made.

Fusion occurs when the non-high vowel /a/ precedes any other vowel, lexically or post-lexically. The surface result of Fusion is a non-high vowel assimilated with the V-PLACE (or lack thereof) of the second vowel. Compensatory lengthening results in a lengthened vowel—e.g. /a-i/ → [ee]. Both a one and two-step analysis of Fusion is possible; the one-step analysis was preferred because of its simplicity. Due to theoretical constraints, it is difficult or impossible to write this rule without referring to /a/ lacking a V-PLACE. Additional research needs to be conducted on the phonological place of central vowels such as [a].

Glide Formation occurs when a high vowel precedes another non-identical vowel. The first high vowel detaches from the mora and connects directly to the syllable node, turning it into a glide. The second vowel is then lengthened via Compensatory Lengthening—e.g. /i-a/ → [yaa].

Post-Consonantal *y*-deletion affects post-consonantal *y* derived by Glide Formation. When this occurs, the *y* is deleted from the intermediate form [Cy].

Palatalization is fed by Glide Formation affecting the Class 5 prefix /di-/. Before Post-Consonantal *y*-deletion occurs, the V-PLACE of the *y* spreads to the preceding *d*, creating a palatalized stop [j]. This rule is unusual in that it only occurs when the first phrasal node dominating the cluster is NP. Syntactically-sensitive phonological rules exist, but are generally related to prosody and not segmental phonology. However, other analyses such as suppletive allomorphy fail to reasonably describe the phenomenon. More research into the relationship between syntax and phonology is needed.

Homorganic Glide Deletion primarily affects a number of verb stems that begin with /yi/ or /wu/. These stems behave as if they were high-vowel initial in regards to Glide Formation, but fail to undergo Fusion. Homorganic Glide Deletion occurs between these two rules, counter-feeding Fusion and feeding Glide Formation.

o-triggered Glide Deletion affects *w* (and possibly *y*) derived by Glide Formation in the context [Cwo]. It is unclear whether or not this rule occurs before or after Post-Consonantal *y*-deletion, so the rule was written as able to delete *y* in this context as well.

/mu/-reduction deletes *u* in the context /mu+C/, and then feeds Nasal Syllabification. This rule, in addition to Nasal Syllabification and Glide Formation, helps explain why the surface forms of the Classes 1 and 3 noun class prefixes and the 2nd person plural subject and object

prefix vary between [mw-] and [m̩]. Nasal syllabification may also affect the copula /ni-/, but more research is needed to see if these two rules are the same.

Intervocalic Glide Deletion affects underlying /awa/ sequences, deleting the *w* to produce a disyllabic long vowel [a.a]. This rule is optional, and occurs both lexically and post-lexically.

The prosodic rules discussed were Penultimate Lengthening and Final Shortening. Penultimate Lengthening occurs when stress is assigned to the penultimate syllable of an utterance. This causes a mora to be inserted, resulting in a penultimate monosyllabic long vowel. Final Shortening occurs when Compensatory Lengthening processes force more than one mora into the final syllable of an utterance. If this occurs, any extraneous moras are deleted. Additionally, more research needs to be conducted into the behavior of long forms and phrases, as the result of Compensatory Lengthening frequently does not surface on syllables preceding the antepenultimate.

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